THE AMERICAN
JOURNAL OF PHARMACY

VOL. 97. AUGUST, 1925. No. 8.

EDITORIAL

WHAT IS "FRESH AIR"?

Great changes have taken place in the engineering principles of ventilation in the last decade or so. Investigations as to the effect of combustion and respiration on the air date back for a considerable period. To Lavoisier must be assigned the credit of the first quantitative experiments, which he began in 1777. He showed that the uncomfortable conditions felt in a closed room cannot be ascribed to diminution of oxygen. A review of some of the earlier knowledge and of the present views is contained in "Health," a monthly publication by the New Hampshire Board of Health, from which some of the data herewith presented have been taken. Lavoisier's view was that the effects of bad air were due to carbon dioxide, a view which prevailed for over a century. Pettenkofer advanced the view that the organic materials from the breath and skin were principally responsible, but experiment has shown that neither the Lavoisier nor the Pettenkofer view is correct, at least does not cover the most important features of the problem. The serious trouble is from the accumulation of heat and moisture. This principle was clearly stated about thirty years ago by a Dutch investigator, and was confirmed in other countries. The theory has been concisely put by the statement that the problem of ventilation is physical not chemical. Detailed investigation by a commission of the State of New York has furnished ample proof of the principle. Persons were placed in a closed apartment and kept there while the oxygen decreased, and carbon dioxide, humidity and effluvia increased. The usual symptoms of "bad air" appeared, headache, lassitude, increased pulse and blood pressure. The persons were then permitted to breathe fresh air through tubes. This did not give relief, but immediate relief was obtained when the temperature of the room was reduced.

From these results inferences are drawn which are materially at variance with the rules advocated by the American Society of

Heating and Ventilating Engineers, which has prescribed positive air change by mechanical means. The alternative advocated by the New Hampshire publication is "ventilation by regulated window inlet and gravity exhaust." It seems, however, that such method is of doubtful value in large cities under present conditions. The smoke nuisance and the automobile horn are too much in evidence for comfort with free window supply. Something may be done, of course, by screens, but the finer dust and noise will not be excluded.

For large auditoriums and college lecture-rooms the most satisfactory system seems to be the so-called "air-conditioning." The air is drawn out of the room by an exhaust fan, carried through a purifier which reduces materially the moisture, removes carbon dioxide and suspended matters and is then ready for re-use except slight diminution of temperature, which can be easily corrected before admitting it to the room. In this way much fuel is saved. There will be, of course, an offset to this saving in the running of the apparatus, but there may be a balance of profit. It should be possible with our present knowledge to apply such methods with entire success.

Further suggestions of radical changes in the construction of lecture-halls may arise from equation of the above facts as regards ventilation with the present facilities for illumination. The methods of illumination have been greatly advanced by the economies in electric lamps, and the careful study of methods of arranging lights, by illumination engineers have made it possible to dispense entirely with windows in the construction of lecture-halls, thus avoiding the irregular air-movements due to the great cooling effects of glass. The lecture-room of the future will be wholly dependent on artificial light, and upon mechanical ventilation. The old-fashioned method of getting light and ventilation through windows which gave little of either is headed for the scrap-heap.

HENRY LEFFMANN.

PHARMACY WEEK.

To arouse the public to a realization that a drug store is professional in character, a national "Pharmacy Week" has been proposed. Pharmaceutical associations and societies, colleges of pharmacy and leaders in pharmacy have already endorsed the movement, seeing in it an opportunity to bring to the public a true visualization of the time honored profession of pharmacy.

Every druggist realizes that there is a growing impression that the modern drug store is no longer, in the strict meaning of the term, a drug store. In this age of commercialism, the professional background of the drug store has become obscured, and the public is forgetting that the drug store is entitled to special respect.

"Pharmacy Week" will provide a means of correcting such mistaken impressions. Through a united exhibition and exemplification of pharmacy it is hoped to convince the public that a drug store is still a place where drugs are sold and professional pharmacy is practiced.

In accomplishing this purpose it is not intended that the store shall interfere with its sale of miscellaneous products. It is expected that the favorable attention attracted to the store will increase public confidence in it and increase its general business.

Briefly, the general observance of "Pharmacy Week" is expected to accomplish the following results:

Convince the public that the drug store is a professional institution.

Establish public confidence.

Build and sustain the confidence of the medical, nursing and allied professions.

Combat the "drugless" drug store idea.

Increase the general business of the drug store.

No specific date for the observance of "Pharmacy Week" has as yet been set. That will be left to a representative committee of the drug trade, which will announce its decision later.

F. B. Kilmer.

ORIGINAL ARTICLES

STUDIES OF TESTS FOR DIETHYLPHTHALATE.

Henry Leffmann and Max Trumper.

The literature relating to the detection of diethylphthalate has become voluminous lately, principally on account of the extensive use as a denaturant for certain types of alcohol. It is largely used in the so-called "rubbing alcohols" which, being intended for external use only, may contain ingredients that render it unfit for drinking. These are usually sold in small amounts—pints or half-pints—at a much lower price than beverage alcohol, but at prices which

afford much profit to both wholesaler and retailer. The ease with which the ester may be removed must give rise to manipulation to fit the sample for drinking, and it is not astonishing, therefore, that chemists who are engaged in the examination of contraband liquors not infrequently find traces of it.

The tests usually employed depend on the property of phthalic acid or its anhydride to form characteristically colored compounds—the phthaleins—with phenolic compounds. The reactions involved are dehydrolyses, that is, attended by separation of one or more molecules of water. The catalysts are, therefore, such substances as sulphuric acid and zinc chloride, but the acid has been almost exclusively employed. Resorcinolphthalein, commonly called "fluorescein," and phenolphthalein are well known. Fluorescein was first obtained by Bæyer in 1871, described in *Ber.*, 1871, *4*, 558. Further information concerning it will be found in *Lieb. Ann.*, 1876, *183*, 23. The phenol derivative was also prepared by Bæyer. Descriptions of methods of preparation will be found in *Annalen* (1880, *202*, 68). A United States Government bulletin, issued in connection with regulations for denatural alcohols, gave a test with pyrogallol, but analysts have generally favored the use of resorcinol, on account of the delicacy and vividness of the fluorescence. Sources of error exist, however, because of the liability of other substances than the phthalates to give slight fluorescence and also because a pseudo-fluorescence may be due to turbifity or dichroism. The phenolphthalein method is not liable to such error, the resulting product having no fluorescence and possessing the property of color difference in acid and alkaline condition. Notwithstanding this advantage, it appears that the value of the phenol test was overlooked until Calvert in 1922 presented a brief communication at the meeting of the Pennsylvania Pharmaceutical Association giving a method for it. This communication appeared in the proceedings of the association, and also in AMER. JOUR. PHARM. 1922, *94*, 702. The process as given by Calvert requires care, negative results being sometimes obtained when the ester is present. The principal cause is probably the lack of control of heating, as high temperatures often interfere with the normal reaction. Breithut and Apfelbaum, presumably unaware of Calvert's suggestion, published in *J. I. E. C.*, 1925, 17, 534, a modification by which the temperature is restricted to 160 degrees C. This gives a very satisfactory result, as we have found by trial. Andrew had already called attention to the danger of high heating in the resor-

cinol method, and modified it by using only the temperature of the open steam bath. Excellent results have been obtained by Andrew's method by several analysts including ourselves. Handy and Hoyt as the result of an extended investigation, state (*J. Amer. Pharm.* Assn., 1924, *13*, 600, 702), that the solution should be allowed to stand twenty-four hours before deciding positively, as some substances other than the ester may give temporary fluorescence that will be misleading. The procedures, as usually given, call for the addition of the phenolic compound, and subsequent addition of sulphuric acid. In some investigations just carried out by us the procedure has been modified by producing sulphonic acids beforehand and using these as reagents. The following experiments are placed on record as a contribution to the detection of the ester.

Phenolsulphonic acid was prepared by dissolving solid phenol in concentrated sulphuric acid. To avoid, as far as possible, the production of disulphonic acids, the proportions taken were approximately those of the molecular weights of the substances: 10 grams of phenol in 5 cc. of the acid. It was found advantageous to dilute this with an equal volume of water. This solution was used with about 15 cc. of a solution of two drops of diethylphthalate in 100 cc. alcohol, following the recommendation of Breithut and Apfelbaum, as noted above, in heating for a short time at 160 degrees C. A positive reaction by production of phenolphthalein was obtained. Much stronger solutions of the ester, such as one of the commercial "rubbing alcohols" gave positive results when the mixture was simply heated in the evaporating dish until a reddish mass was obtained, but the same method did not succeed with the very dilute solution. It appears then that the procedure involving the use of phenol can be somewhat simplified by preparing the sulphonic acid beforehand.

The resorcinol test as perfected by Andrew seems to be entirely satisfactory, but it was thought worth while to try the sulphonic acid method. Inasmuch as resorcinol is more complicated than phenol, it is not possible to control the formation of the derivatives, and the solution was made by dissolving a few grams of it in strong sulphuric acid. Such solutions almost always solidify on standing, and this change occurred with the one we used, although a notable amount of water was added. The solid can, however, be readily melted in warm water. With this compound a test on the dilute solution of the ester was carried out on the principle of Andrew's test, that is not

heating the mixture above the temperature of boiling water. Very decided positive results were obtained. No advantage results in this method from heating the mixture to 160 degrees C.

Experiments were then made to determine if some of the other familiar phenolic compounds could be used. It is known that with the test as ordinarily applied, in which an alkaline residue is obtained on the first evaporation, such substances as hydroquinone, pyrocatechol and pyrogallol are useless, as they promptly oxidize and become dark in alkaline solution. This difficulty does not occur when they are added in mixture with sulphuric acid. Experiments were made with sulphuric acid solutions of pyrocatechol, hydroquinone, pyrogallol, alpha and beta-naphthol, but no decisive reactions could be obtained. Slight fluorescences were produced even when the ester was not present. Several modifications were tried but with no better results.

In view of the observation of Handy and Hoyt that temporary fluorescence may be obtained when phthalate is not present, it was thought worth while to examine whether any of the common accessories of crude spirit might cause this result. Acetone and acetaldehyde were chosen. It was found that the former did not under any of the conditions employed give a fluorescence, but a very distinct temporary effect was obtained when small amounts of acetaldehyde were added and the higher temperatures used. No effect was obtained when the low temperature prescribed by Andrew was applied.

ANIMAL AVIATORS.†

By Marin S. Dunn,
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In these days of wonderful improvements in aviation, it is with increased interest that we turn our attention to methods of flight developed in the various phyla of the animal kingdom. The term "animal" is used in this paper in its broadest sense and is not confined to mammals alone. It is common knowledge that most insects and birds fly. Insects we know, are more numerous than all other terrestrial animals, and birds, also, are more numerous (12,000 or

†One of a series of popular lectures presented at the Philadelphia College of Pharmacy and Science, 1924-1925 season.

more species) than other terrestrial vertebrates. Therefore, from the standpoint of number of species, the ability to fly is the rule for land animals. This power as we shall see has arisen independently at different times in various groups.

In addition to those animals possessing true flight (insects, birds, bats), certain other forms although they cannot be said to truly fly, are nevertheless capable of gliding or parachuting movements. Their bodies are not sustained in the air by volitional wing beats as in the case of the insect and bird but they are equipped with some type of apparatus for gliding or sailing through the air. To the last mentioned type of animals belong the flying frog, flying dragon, flying squirrel, flying squid, flying lemur, flying gecko, flying phalanger, and possibly the flying fish.

It is the purpose of this paper to discuss briefly in the following taxonomic order those animals which have the power of true flight or of gliding movements.

Phylum *Mollusca*—flying squid.
Phylum *Arthropoda*—
  Class *Insecta*—insects.
  Class *Arachnida*—ballooning spiders.
Phylum *Chordata*—
  Class *Pisces*—flying fish.
  Class *Amphibia*—flying frog.
  Class *Reptilia*—*Pterosauria,* flying gecko, flying dragon.
  Class *Aves*—birds.
  Class *Mammalia*—flying phalanger, the flying lemur, bats including the flying foxes, the flying squirrels.

Flying Squids.

These animals are members of the Phylum *Mollusca* to which belong the snail, the oyster, the octopus, etc. They have elongate cylindrical bodies with terminal joined fins. At the head end, there are four pair of shorter arms equipped with suckers and one pair of long tentacular arms. *Ommastrephes illicebrosus,* Verrill, the Short-finned Squid, occurs in our northern Atlantic waters where it feeds on schools of herring and mackerel. The prey is caught by the arms of the squid and killed by biting in the back of the neck. Squids are attracted by light, and they are caught in numbers by the fishermen of New England and the St. Lawrence (Rodgers, 11)

who either row out in boats with bright lights and after attracting the animals row toward shore where the squids ground themselves, or they may directly place lights upon the shore and capture the creatures as they swim in. Squids are thus captured by the thousands and used as bait for the larger sea fish. Flying squids have been known to rise from the ocean and throw themselves upon the deck of low vessels, the leap being fifteen to eighteen feet above the water.

Insects.

By far the most numerous of the flying animals are the insects. These little creatures, unless they attract our attention by some unpleasant effect such as the Clothes-moth, the Mosquito, the Boll Weevil or the Japanese Beetle or inspire our curiosity by their strange form as the Praying-mantis or unless they cause our admiration by their magnificent coloration as some of the dragon flies, butterflies and beetles, often pass unnoticed. Insects are air-breathing *Arthropods* having a distinct head, thorax and abdomen, a pair of antennae, three pair of legs and most frequently one or two pair of wings in the adult state.

The wings of insects are at first soft little sacs permeated by breathing tubes. In the pupal stage, they grow out from the sides of the thorax above the insertion of the legs. After transformation has occurred and the pupal skin is thrown off, the wings expand with air and enlarge to many times their size. Packard (10) defines the wings of insects as simple expansions of the crust, spread over a framework of horny tubes. These tubes are really double, consisting of a central trachea or air tube, inclosed within a larger tube filled with blood and which performs the functions of the veins. Hence the aeration of the blood is carried on in the wings, and thus they serve the double purpose of lungs and organs of flight. The wing is divided by its veins into cells. The terms "costa," "subcosta," "radius," "media," "cubitus" and "anal" are names given to principal longitudinal veins. The venation of the wing often plays an important part in our system of classification. It is interesting to note that specialization may result in either the reduction by the atrophy of veins or by the coalescence of two or more adjacent veins or by the multiplication of the principal veins.

Insects usually have two pairs of wings. One pair attached to meso—and one pair to the metathorax. In certain groups, however, these may only be one pair, generally the anterior as in the

Diptera or order of the flies. Through lack of use, both pairs of wings may degenerate, a condition we find in fleas and bird lice.

Wings of insects vary greatly in the different groups. Often the front wings may be modified into protective coverings such as we see in the *Orthoptera* and more especially in the *Coleoptera* or beetles. Thus the horny elytra of the beetle are really protective modifications of the fore wings. In the *Diptera* or flies, the hind wings form a pair of beautiful balancing organs, the halteres.

The color of insects is due to (1) structures which cause interference of light, (2) internal pigments, (3) a combination of both. Folsom (4) states that "the iridescence of a fly's wing and that of a soap bubble are produced in essentially the same way. The wing, however, consists of two thin, transparent, slightly separated lamellae, which diffract white light into prismatic rays, the color differences depending upon differences in the distance between the two membranes." The straited scales of a butterfly wing act like diffraction gratings and produce the beautiful colors we know. In the case of the *Coleoptera,* small lines or pits often cause the diffraction of light. Colors due to internal pigments formed by the cells below the outer cuticle are often seen in the form of hypodermal and cuticular pigmentation. This may be seen easily in our common potato beetle. In other cases, the beautiful colors may be due to combinational effects.

It has been found that the tip of an insect wing describes an elongate figure "8" the wings of the two sides beating at the same time. We may easily see this for ourselves if we fasten a small bit of gold leaf to the tip of an insect wing and allow the wing to be freely vibrated in the light while held against a dark cloth. As a rule, the smaller the insects wings, the more rapid the rate of vibration. According to Folsom, a butterfly (*P. rapae*) makes nine strokes per second, a dragon fly twenty-eight, a sphingid moth seventy-two, a bee one hundred and ninety and a house fly three hundred and thirty.

The success of insects as a group may be in large measure attributed to their development of their powers of flight, and their ability to be blown by the wind. In distribution, they are almost worldwide from the Arctic to the Anarctic circle. They are found on high mountains (*Emesa* sp. recorded in Ecuador at 16,500 ft.), in caverns, hot springs, deserts and a few in salt water. Some beetles, dragon-flies and butterflies, etc., migrate at certain times in immense numbers.

Spiders.

Certain spiders although they have legs may also use the wind for the purpose of travelling from place to place. Their method of locomotion is like that of a balloon or dandelion seed. On warm fall days, the young spiders climb to the top of a convenient post, twig or herb and lift their abdomen, spin their silken threads. After a time, if there be sufficient breeze, the animal floats away buoyed up by the silken mass in the current of air. Comstock (2) speaks of the showers of gossamer that result when numbers of these spiders attempt to fly when the wind is too strong and the threads are not carried up but blown against some nearby object. He adds: "On one occasion I saw a ploughed field that was covered with a sheet of silk. It was evident that an immense number of small spiders had attempted to fly but that the wind had blown their threads merely from the crest of one furrow to another. Although the field was completely covered with the sheet of silk, so delicate was this fabric that it was invisible except where the light of the sun was reflected directly to the eye of the observer; the appearance being like that of the wake of the moon on slightly disturbed water."

Flying Fish.

The power of journeying through the air has been developed principally in two widely separated families of fish, the *Exocoetids* which are soft-finned and unarmed, and the armed *Dactylopterids*. Their power of suspension in the air is brought about by the remarkable elongation of the pectoral fin rays and an extension of the interradial membrane (Fig. 1). The pectoral muscles, on the other hand, are but little more developed than in those fishes having normally strong pectoral muscles. This is in marked contrast to the pectoral muscles of birds.

The members of the *Exocoetidae* are well fitted by form for travel both in air and water. The sharp cut front and the subfusiform shape is of great value. The long lower lobe of the caudal fin allows great power to be given to the jump as the fish leaps from the water. According to Gill (6), there are about twenty species in American seas. Important among these are *Cypselurus xenopterus, C. californicus* and *C. callopterus* of the Pacific and *C. gibbifrons* and *C. cyanopterus* of the Atlantic. These small fishes (the length of adults of different species about 8 to 18 inches) swim in schools

propelled by strong, sweeping strokes of the posterior end of the body and the tail.

Their food consiss of crustaceans, molluscs and various small fish. They are preyed upon by dolphins, sharks and large fish. Probably many species spawn far from land although they have been recorded in about the rocks of Chincha Islands on the coast of Peru.

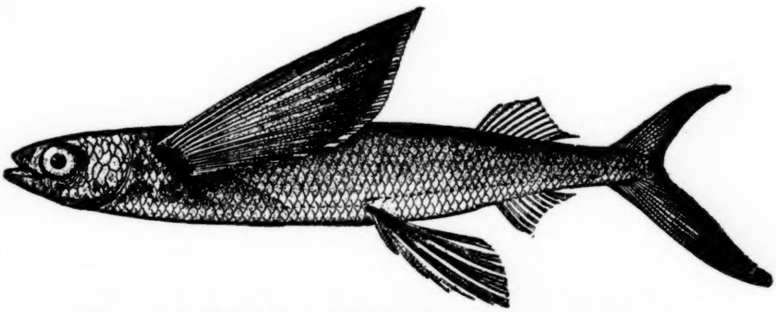

FIG. 1—CALIFORNIA FLYING FISH (Cypsilurus californicus). Nature Library. Fishes. Jordan & Evermann.

The *Dactylopterids* or flying Gurnards with oblong shaped heads are covered with hard-keeled scales. The pectoral fin has a short anterior lobe. They are essentially bottom fish often touching supporting objects with down pointed ventral fins. *Dactylopterus volitans* is an inhabitant of the Atlantic Ocean. The back is brown with dark spots, the sides rose with silvery reflections and the outspread wings have rows of black and white eye-like spots. *Dactylopterus* possesses the power of changing its color from light to dark or vice versa. Many observers have never seen them fly, but on the other hand, Moseley of the Challenger Expedition observed them rising to a height of about a foot above the water and flying fifteen to twenty yards. Undoubtedly, their diet is one of small crustaceans and tiny fish.

There is great difference of opinion as to whether flying fishes really possess true flight. Möbius, Boulenger and others believe that flying fishes have no power of volitional wing beats and that their flight is merely a powerful jump followed by a continued parachuting with outspread pectorals until the fish lands with a splash. On the other hand, Jordan and Evermann (9), however, state: "Probably the differences in opinion are largely explained by the fact that the different observers have studied different species. Some species, at

least the larger ones have a real flight; the pectoral fins vibrate, and the flight can be prolonged almost indefinitely." Later we read: "The senior author of this work dissents from this common view expressed above, and does not believe that the pectoral fins have any large power of motion of their own, but that they quiver or vibrate only when the muscles of the tail are in action." Moseley watched Flying Gurnets move their wings rapidly in flight. Hankin (7) who has seen a flying fish make a sharp turn round the transverse axis as it reached the top of a wave, observes: "When we consider the distances covered by flying fishes, their high speed, and the apparent uniformity of the rate at which they move, it becomes difficult to accept this view" (*i. e.*, that flight merely consists of a jump out of the water lengthened out by the supporting power of the wings, and that there is no extraneous supply of energy or propulsive effort, and that the animal falls headlong into the water as soon as its momentum is exhausted). The last-mentioned investigator thinks that flying fish obtain energy from the air in the same unknown way as does the soaring bird.

Flights of 450 and 800 meters have been recorded.

Flying fishes furnish excellent food and because of this, they are eagerly sought for in certain localities. Gill (6) in his report, quotes the following passage concerning flying fish catching (*Cypselurus speculiger*) in the island of Barbados. The fishing grounds are "little more than 10 or 12 miles from home" some not more than five. "There are about 200 boats engaged in the fishery. Nowise notable for grace of form or elegance of rig, they are substantial, undecked vessels of from 5 to 15 tons capacity, built in the roughest manner, and furnished in the most primitive way. The motive power is a gaff mainsail and jib and a couple of sweeps for calms. . . . The fleet leaves the 'canash' (harbor) before daybreak, each skipper taking his own bearing and working for the spot which he thinks will furnish the best results. . . . The tackle used is of the simplest kind. A wooden hoop 3 feet in diameter, to which is attached a shallow net with inch meshes; a bucketful of—well, not to put too fine a point on it—stinking fish; a few good lines and hooks and a set of grains, form the complete layout. . . . As soon as the boat is hove to and her way stopped, the usual exuberant spirits and hilarious laughter are put and kept under strong restraint, for a single sound will often scare away all fish in the vicinity and no more be seen that day. The fisherman leans far over the boat's side,

holding the loop diagonally in one hand. The other hand, holding one of the malodorous fish before mentioned, is dipped into the sea, and the bait squeezed into minute fragments. This answers a double purpose; it attracts the fish, and the exuding oil forms a 'sleep' or glassy surface all around, through which one can see to a great depth. Presently sundry black specks appear far down; they grow larger and more numerous, and the motionless black man hanging over the gunwale scarcely breathes. As soon as a sufficient number are gathered, he gently sweeps the net downward and toward the boat withal, bringing it up to the surface by drawing it up against the side. Often it will contain as many fish as a man can lift; but so quietly and swiftly is the operation performed that the school is not startled, and it very often happens that a boat is filled (that is, 7000 or 8000 fish) from one school. More frequently, however, the slightest noise, a passing shadow, will alarm the school; there is a flash of silvery light, and the water is clear, not a speck to be seen. Sometimes the fleet will return with not 1000 fish among them, when prices will range very high until next day, when, with 50 or 60 boats bringing 5000 to 6000 each, a penny will purchase a dozen."

FIG. 2—RHACOPHORUS PARDALIS (From Wallace Malay Archipelago). Taken from Gadow.

Flying Frog.

Ceratin species of true frogs of the genus *Rhacophorus* of the class *Amphibia* are remarkable for the great size of the fully webbed hands and feet which are often used as parachutes. *Rhacophorus* is a large genus with over forty species, one dozen at least in Madagascar, eight or nine in Ceylon, the others in Southern Asia, the Philippines and Malay Islands extending into China and Southern

Japan. *Rh. pardalis* (Fig. 2) lives in Borneo and the Philippines. Specimens have been measured and the following values obtained: Total length, 6.5 cm. or 2½ inches, area of one fully expanded hand 3.4 sq. cm., area of one fully expanded foot, 6.0 sq. cm. It has been reported coming down from trees in a slanting direction making use of its webs as parachutes. *Rh. reinwardti* as described by Gadow (5) lives in mountain forests of Java and Sumatra. It has a length of three inches. In color, it is green above and yellow below. Young specimens have blue patches on the webs of hands and feet and behind the armpits. "Besides the flap on the heel and the curious cutaneous fringe on the forearm, suggestive of an incipient flying membrane, the skin forms a projecting fringe on the inner side of the fifth toe and a transverse flap above the vent."

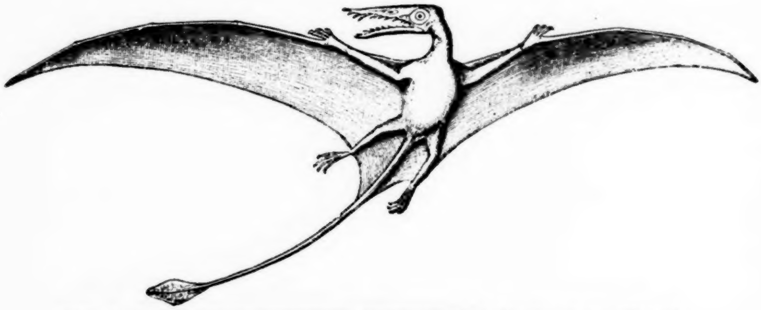

FIG. 3—RHAMPHORHYNCHUS MUENSTERI (Restored by Marsh). (From Geikie.) Taken from Gadow.

Pterosauria.

These animals were flying reptiles of the Mesozoic Era. The fore limbs were modified into wings, and the patagium or membrane was carried by remarkably elongated ulnar finger (Fig. 3). They were rather a distinct group which probably had no relationship to birds even though there are a number of resemblances brought about by their mode of life. The skull presented a few features of the *Rhynchocephalia* and the pelvis, *Crocodilian* characteristics. The hand had four phalanges and the feet five separate toes. Apparently, they reached the height of their development in the Upper Cretaceous and then died. *Dimorphodon macronyx* had a total length of three to four feet. This measurement included the large skull (nine inches) and two-foot tail. The patagial finger was about twenty inches and the entire wing twenty-eight inches. *Rhamphorhynchus*

longicaudatus had membranes which extended to the kneee, and the inside of the hind limbs was connected by a membrane to the tail. Even the tip of the tail carried a membrane expansion. Other genera were *Ornithocheirus, Pterodactylus* and *Pteranodon. Pteranodon longiceps,* from the Middle Cretaceous of Kansas, had a length of skull of two and one-half feet and a spread of wings of nearly twenty feet.

Flying Gecko.

The Geckos are a large family of lizards containing about forty-nine genera and 270 species, confined to the warm parts of the world. They are usually active at night and by means of special structures under the toes are able to climb over trees and walls. The tongue is protrusible and broad. One of the genera, *Ptychozoon* is called the flying gecko because of its almost completely membraned form. These expansions are reported to act as parachutes when the animal is in the air. *Ptychozoon homalocephalum* lives in the Malay Peninsula and adjacent islands.

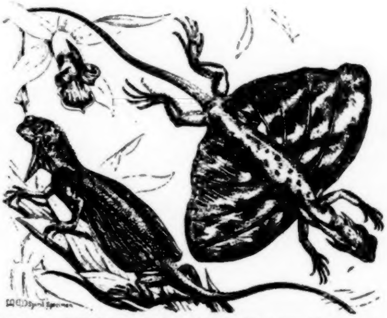

FIG. 4—DRACO VOLANS (Flying Dragon). From Amphibia and Reptiles, Gadow.

Flying Dragon.

The flying dragons are members of the genus *Draco* of the old world lizards or *Agamidae*. They have a broad, short tongue and the teeth are set on the edge of the jaw bone. From the sides of the body arise a pair of large membranes supported by five or six of the elongated posterior ribs. These expansions may be folded like a fan. *D. volans* of Sumatra, Java, Borneo and the Malay Peninsula is about ten inches in length inclusive of the five-inch tail (Fig.

4). There are three pointed appendages on the throat, the middle one longer than the other two. The upper part of the male has a metallic sheen with dark spots upon a brown ground color. The wings are orange with black markings. Gadow (5) gives the following description: "Certainly they do not fly by moving the wings, but when at rest upon a branch, amidst the luxurious vegetation and in the immediate neighborhood of gorgeously colored flowers, which partly conceal them by their likeness, they greatly resemble butterflies, especially since they have the habit of opening and folding their pretty wings." Hankin (7) states that they can glide forty to fifty meters and do so with a loss of height of about one in four. They have been seen steering to avoid trees, and they probably feed on ants which they catch on the tree trunks.

Birds.

Birds are wonderfully adapted for flight. Their hollow light bones, their air sacs, their possession of feathers and their modified fore limbs or wings, placed high up the body, their well developed pectoral muscles, and bodies which offer but little resistance to the air make them remarkably fitted for aerial progress. Birds and feathers are associated inseparably in our minds, but few of us stop to think what a wonderful structure a feather really is. These structures arise from dermal papillae with a covering of epidermis as do reptilian scales, and enveloped in a feather follicle. Hegner (8) gives the following description of a typical feather: This "consists of a stiff axial rod, the scapus or *stem;* the proximal portion is hollow, and semitransparent, and is called the quill or calamus; the distal portion is called the *vane,* and that part of the stem passing through it is the *shaft* or rachis. The vane is composed of a series of parallel *barbs,* and each barb bears a fringe of small processes, the *barbules,* along either side. The barbules on one side of the barb bear *hooklets* which hold together the adjacent barbs." The down feathers possess a soft shaft and a vane without barbs.

The color of the feathers may be due to chemical causes (pigments within the feathers), to structural peculiarities, or to both. The color of the individual bird varies throughout its life. The color of the nestling bird changes to that of the generally dull, immature plumage. The two sexes often differ in color, and the male is especially prone to bright colors during the breeding season.

In flight the wing works on the principle of the inclined plane, and both up and down strokes propel the bird forward. The wing tip describes a figure eight as it is forced downward and forward, and then upward and backward. Various birds travel at different rates, the carrier pigeon has a racing speed of about thirty-five miles an hour, and ninety miles per hour has been recorded for ducks.

The fascinating subjects of bird classification, nests, song, migration and importance cannot be discussed at this time and the interested reader is referred to many excellent publications concerning them.

Soaring.—Apparently the soaring flight of birds of temperate climes differs from that of the soaring flight of the inland tropics. In the former case, the birds owe their soaring ability to their success in finding and using ascending air current while in the latter, the birds actually avoid such currents. Hankin (7) who has extensively studied among others the "cheel" (*Milvus govinda*) in the Agra district observes that in fine weather there is a definite time at which soaring commences. Apparently within two or three minutes the air becomes capable of soaring flight. Before this time, however, the cheels may be seen in flapping flight. The birds start soaring in order of their loading (weight lifted per unit of supporting area) the heavier the bird, the later their start. As the air becomes soarable, the bird is able to travel horizontally in soaring flight without loss of speed. The soarability of the air may be defined as that condition which enables it to support soaring flight. In his work, Hankin observes two kinds of soarability (1) sun soarability which only occurs in the presence of sunshine and may be present in the absence of wind and (2) wind soarability which may occur in the absence of sunshine. In the latter case, the strength of the wind is not an index to the soarability for some strong winds may be completely unsoarable, and the birds apparently take pains to avoid ascending air currents since they cause instability.

Flying Phalangers.

These small mammals belong to the order *Marsupialia* together with the kangaroos, the wallabies, the opossums, the pouched mice, the wombats, the banded ant-eater, etc. The tail is long and prehensile and the pouch is well developed. There are at least three genera of flying phalangers. *Petaurus* (three species) has parachute-like expansions of the skin between the fore and hind limbs

and large naked ears. *P. breviceps* has a body eight inches long bearing a nine-inch tail. *Petauroides,* the second genus has a partly naked tail. *Acrobates,* a tiny animal, is not more than six inches long including the tail.

These forms cannot fly but only parachute down through the air. Beddard (1) remarks that it is interesting to note that the same method of flight has been independently evolved three times, for each of the three genera is specially related to a separate type of non-flying Phalanger.

Flying Lemur.

This strange animal, *Galeopithecus* (Fig. 5), probably an aberrant *insectivore,* although it has been referred to the lemurs and bats, inhabits the forest of the Philippines and other islands of the Indian Archipelago and also the Malay Peninsula. During the daytime, it hangs head downward like a bat from a limb but at night, it glides through the forest in search of food. It attains the size of a cat, and

FIG. 5—GALEOPITHECUS (After Vogt and Specht). From Biology, Parker and Haswell.

is remarkable for its well developed patagium or gliding membrane, supplied with muscles. This patagium extends from the neck to the fore limb, from the fore limbs to the hind limbs and from the hind limbs to the tail. In respect to the degree of development, the patagium is between that of *Sciuropterus* (a flying squirrel) and the bat.

Bats.

Bats are truly flying mammals. Their fore limbs and the fingers particularly are elongated greatly. Expansion of the skin in the form of membranes spreads over this bony framework and con-

nects also with the sides of the body and the hind limbs. Another membrane, also, may stretch in the space between the hind legs and more or less completely connect with the tail (Fig. 6). The knees are bent backwards causing walking to be difficult. The ear has an elongated lobe or tragus, and the nose usually strange complicated membranes. The latter may be due to secondary sexual characteristics or perhaps function as tactile organs.

FIG. 6—BAT (Synotus barbastellus). (After Vogt and Specht). From Biology. Parker and Haswell.

Bats (more than 600 species), are almost world-wide in distribution and range in size from the big Malayian flying foxes (*Pteropus,* with nearly sixty species from Madagascar to Queensland, *P. edulis* has been reported to attain a wing expansion of five feet) to creatures the size of a mouse.

Nocturnal in habit, bats pass the day in hanging by their feet in caverns, hollow trees, old barns, etc. (Andrews has found a diurnal flying fox on Christmas Island.) "In winter many bats hibernate in similar quarters, but there is also a southward migration

of certain species, like that of birds," Stone and Cram (12). Their voices are squeeky and high. Two young seem to be the general number among our eastern bats. These are born in July.

The following classification of our American bats is taken from the above-mentioned authors.

I. Leaf-nosed Bats. Family *Phyllostomatidæ*. Size large, tail usually wanting, a curious leaf-like appendage on the end of the nose.

II. Free-tailed Bats. Family *Noctilionidæ*. Size, rather small, tail present but the terminal half free from the interfemoral membrane, projecting beyond it. No appendage on the nose.

III. Common Bats. Family *Vespertilionidæ*. Similar to the last but with interfemoral membrane reaching to the tip of the tail.

Two common species of bats found in the vicinity of Philadelphia are the Large Brown Bat, *Vespertilio fuscus* (Beauvois), which may often be seen in summer and fall about electric lights industriously wheeling and flying in search of its insect prey, and the Red Bat, *Lasiurus borealis* (Müller), with bright rufous fur.

The true blood-sucking bats of which we have heard so many stories are South American and belong to the genera *Desmodus* and *Diphylla* of the family *Phyllostomidæ*. *Desmodus rufus* is the true Vampire bat. The bloodsuckers are devoid of tail and true molar tooth, but the front teeth are sharp and cutting, and the blood of cattle, horses, etc., is lapped up as it oozes from the wound.

Flying Squirrel.

Any one who has seen these beautiful furry little creatures at home will be eager to learn about their habits and manner of life. But notwithstanding, not a great deal is known concerning them. They belong to the Order *Rodentia*. *Sciuropterus volans* (Linnæus) has a length of about nine to ten inches, and the skin of the sides of the body may be produced to form a parachute or patagium. They are nocturnal and jump from tree to tree spreading their legs and thus expanding the parachute to assist them while in the air. The top of a tree with decayed center furnishes them an excellent home. During the day, they sleep in the nest but with evening, they are astir, scampering through the trees as they pursue one another or look for food. They have been known to leap fifty yards from the top of a tree to the bottom of another. Two to four young are said to be reared in the nest.

Pteromys, about twelve species, is an inhabitant of the old world. They are sometimes called flying marmots or flying cats. Their membrane extends from toes to wrist and an additional membrane unites anteriorly the forelimb to the neck and posteriorly the hind limbs to the root of the tail. They are larger than *Sciuropterus* reaching 16-18 inches, exclusive of tail. They live on beetles, nuts, etc., and have been known to jump nearly eighty yards, and it has been said that they are able to steer while in the air.

It may thus be seen that the power of aerial navigation has been developed independently in a number of different groups of animals and also in some cases in the same group (fish, phalangers, etc.). Of course it is easily understood that the groups possessing it have great advantages with respect to dispersal and geographical range. Barriers, otherwise impassible such as oceans, lakes, mountains, etc., are safely crossed. (A cuckoo, for example, is known to spend its winters in Fiji and certain other islands of the Pacific and its summers in New Zealand, travelling in all a distance of about 3000 miles each year. The golden plover travels from the Arctic circle to the Argentine and Southern Brazil and back again each year, a distance measured on its elliptical path of about 20,000 miles.) Flight also is of great value in escaping from enemies and in the obtaining of food. This latter advantage is well shown by the spread of some of our obnoxious insect pests.

It seems fitting to conclude this article with a few sentences by Darwin (3) from his "On the Origin of Species" dealing with the origin and transitions of organic beings with peculiar habits and structure. "Look at the family of squirrels; here we have the first gradation from animals with their tails only slightly flattened, and from others, as Sir J. Richardson has remarked, with the posterior part of their bodies rather wide and with skin on the flanks rather full, to the so-called flying squirrels; and flying squirrels have their limbs and even the base of the tail united by a broad expanse of skin, which serves as a parachute and allows them to glide through the air to an astonishing distance from tree to tree. We cannot doubt that each structure is of use to each kind of squirrel in its own country, by enabling it to escape birds or beasts of prey, or to collect food more quickly, or, as there is reason to believe, by lessening the danger from occasional falls. But it does not follow from this fact that the structure of each squirrel is the best that it is possible to conceive under all natural conditions. Let the climate

and the vegetation change, let other competing rodents or new beasts of prey immigrate, or old ones become modified, and all analogy would lead us to believe that some at least of the squirrels would decrease in numbers or become exterminated, unless they also became modified and improved in structure in a corresponding manner. Therefore, I can see no difficulty, more especially under changing conditions of life, in the continued preservation of individuals with fuller and fuller flank-membranes, each modification being useful, each being propagated, until by the accumulated effect of this process of natural selection, a perfect so-called flying squirrel was produced."

"Now look at the Galeopithecus or flying lemur, which formerly falsely ranked amongst bats. It has an extremely wide flank-membrane, stretching from the corners of the jaw to the tail, and including the limbs and the elongated fingers: the flank-membrane is, also, furnished with an extensor muscle. Although no graduated links of structure, fitted for gliding through the air, now connect the Galeopithecus with the other Lemuridæ, yet I see no difficulty in supposing that such links formerly existed, and that each had been formed by the same steps as in the case of the less perfectly gliding squirrels; and that each grade of structure was useful to its possessor. Nor can I see any insuperable difficulty in further believing it possible that the membrane-connected fingers and forearm of the Galeopithecus might be greatly lengthened by natural selection; and this, as far as the organs of flight are concerned, would convert it into a bat. In bats which have the wing-membrane extended from the top of the shoulder to the tail, including the hind-legs, we perhaps see traces of an apparatus originally constructed for gliding through the air rather than for flight."

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DIFFERENCES IN THE PHARMACOLOGICAL EFFECTS OF DRUGS UPON ANIMALS AND MAN.*

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Introduction.

The friends and acquaintances of this writer are aware that since the introduction of vivisection and animal experimentation he has refrained from considering as a standard that method of establishing a remedy. A critic, friendly, or unfriendly, might argue this is solely because of inexperience in these directions, or he might say that, in the face of the belief held by so many in the value of animal experimentation as a standard, this attitude comes only from lack of personal and experimental knowledge.

Be this as it may, the writer has seen no reason to accept a change of views nor to abandon the standardizing records tabulated through the decades by physicians of experience in clinical processes. Nor does he consider himself altogether inexperienced in the opportunities for balanced thought, as is evidenced by his studies of animal experimentation, made as early as 1885, in connection with the talented authority of that date, Dr. Roberts Bartholow. As authori-

*Permission is granted for simultaneous publication in a medical journal.

tatively bearing on this subject, the reader may be referred to "Drugs and Medicines of North America," 1885 and subsequent issues.

With the object of self-information only, the writer recently requested Dr. Wolfgang Ostwald to select an authority, unquestionably qualified, to present the problem of animal experimentation, considering the question of the animal as a standardizer. This was to cover the field of the variations likely to occur when animal experimentation results are accepted as a standard for the therapeutic or physiological action of a drug.

Dr. Ostwald selected Dr. Fritz Külz, of Leipzig, who contributed an article in the German language, which (as translated by Dr. Waldbott) the writer of this paper studied most carefully. His conclusion from this study was that animal experimentation as a standardizer for pharmaceutical preparations in which he is concerned could not have a part, and would not be accepted by him as a factor needed in the direction of his pharmaceutical activities.

This paper is of such importance to him that he feels it is but proper and just to contribute the research of Dr. Külz to the readers of this journal.

No attempt to summarize the paper is made by the writer of this introduction—each reader can do that for himself—nor does he propose to enter into any discussion with any one concerning the subject, in part or as a whole. Dr. Külz's paper follows.—J. U. L.

* * *

Pharmacology owes its rise since the middle of the last century to the introduction of experimental methods, and, above all, to that of experiments upon animals. While it is true that clinical observations on man have furnished valuable material, a thorough analysis of the poisonous effects and a more exact determination of the points of attack were rendered possible only after we gained experience by experimentation upon animals, which permits changing at will the experimental conditions. Only persons of preconceived notions will deny that in certain directions there is an absolute necessity for such experiments, impossible to be replaced thus far by any other method. On the other hand, we must realize there are definite limitations to experiments on animals. First, we must never lose sight of the fact that, strictly speaking, the results of such experiments refer only to the behavior of the species of animal used, and in the case of some poisons or some animals the conclusions must be fur-

ther limited to the individual animal experimented on. A parallelism of experimental results to another animal or to man is all allowable only under the exercise of the greatest caution, and with thoughtful regard to the biological and anatomical conditions involved. Otherwise, such conclusions, in many cases, may lead to false results. It is always the experiment which must decide.

This fact is often forgotten, frequently new drugs being recommended in therapy for human beings without sufficient clinical trial, they having been tested only by a few experiments on animals. Such procedure may lead to serious errors, as will be illustrated by the following several examples, which demonstrate the difference in the action of poisons on different living organisms, in quantitative as well as qualitative respects.

That this difference in activity has not been more generally appreciated seems strange, in view of the fact that a great branch of pharmaco-therapy, namely, chemo-therapy of infectional diseases, is based on this very difference in sensitiveness of man and animal towards poisons, the chemotherapeutic agent being intended to destroy, without the least possible harm to the human organism, the agent causing the disease.

One may rejoin that in this case both organisms—for example, man and trypanosoma—occupy opposite ends of the animal series, and that differences here in the poisonous action are not surprising. But, again, in a branch of this very subject of chemo-therapy, *i. e.,* the atoxyl treatment, we have had some sad experiences, due to the different effects of one and the same agent upon man and the higher animals. It is well known that in man frequently the application of atoxyl has been followed by *blindness,* which previously conducted experiments upon animals did not give cause to suspect. It was later found that different species of animals react differently towards this agent. Dogs and rabbits, when chronically poisoned by atoxyl, die of hemorrhagic nephritis, while in the cat there will be ataxia and spastic paralysis as a consequence of central disturbances (Jgersheimer, *Arch. exp. Path. u. Pharm. Suppl.,* 1908, p. 283).

It is interesting to note that a difference in the distribution of the poison in the dog and the cat may be demonstrated (Jgersheimer and Rothman, *Z. Physiol. Chem.,* 59, p. 256, 1909). With the dog arsenic is found in the interior organs, the brain remaining free, while in the cat the reverse is the case. Arsenic was also found in the eyes of the animals, yet blindness from this source in animals has

not been recorded. This is probably because in experiments upon animals the doses were relatively high, and as a result pronounced chronic effects could not develop in the central nervous system. Since the cat behaves toward the poison more like man than does the dog, perhaps there is still a possibility of inducing experimental blindness in cats.

At all events, the example of atoxyl shows that experiments upon animals have not uncovered any decisive property of this agent that would be useful for human therapy, and, secondly, that different animals react altogether differently toward this one agent. The cause of this difference has been demonstrated to be a difference in the distribution of the poison, the reason for which is unknown, but which, nevertheless, is a striking phenomenon in animals like the cat and dog, which are biologically not far removed from each other.

It need not surprise us that, considering their entirely different structural organizations, differences have been found between carnivora and herbivora. In certain cases we know the cause of the difference in resistance. For example, dogs are much more resistant toward acid poisoning than are rabbits, because, being carnivorous, they form more urea, which, changed into ammonium salts in their economy, may neutralize the introduced acid. In herbivora this available alkali reserve is soon used up, and for this reason they succumb to much smaller quantities of the acid.

Other and more general rules have been observed. For example, herbivora, notably ruminants, are much more sensitive than carnivora towards metal salts, especially when given by the mouth, very likely because more of the poison is absorbed in the long intestines of the herbivora, as it remains therein for a much longer time. The lethal dose of calomel is the same (ten grams) for cattle and the hog, notwithstanding the considerable difference in their body weights. Thirty grams of blue ointment may be rubbed into the body of a dog without injuring it, while the same quantity applied to an ox will be fatal to the animal. (Fröhner, "Toxicology for Veterinarians," Berlin.)

The latter observation shows that differences in intestinal resorbability do not afford the only explanation of differences in sensitiveness of various animals, since, *e. g.*, horses are also much more resistant toward blue ointment. From reliable observations (Schubarth, quoted by Fröhner) it required not less than 3240 grams of blue ointment to kill a horse.

These figures are probably sufficient to show what errors may occur if we were to draw conclusions from an agent proving innocuous for one species of animals, arguing therefrom that it should be harmless for another.

The previous examples, it is true, deal with animals not very closely related in kind, but the history of a scientific controversy that took place about the year 1870 on the subject of the action of caffeine on the frog shows that poisons may act altogether differently on different sub-species of the same genus. One group of pharmacologists described increase of reflex action and tetanic cramps as the dominating symptoms of the manifestations of activity, while others recorded a change in the muscular system, which was put into a remarkable state, similar to *rigor mortis.* Schmiedeberg, while at Dorpat, always observed the latter phenomenon, but when at Strassburg did not succeed in obtaining the same effect; on the contrary, the increased reflex effect there became manifest.

This remarkable result suggested to Schmiedeberg that the widely different action must be due to the species of frog used. At Dorpat he had been working exclusively with grass frogs (*Rana temporaria s. fusca*), at Strassburg with water frogs (*Rana esculenta*). Experiments tending in this direction confirmed his supposition. Later exact measurements conducted by Jacoby and Golowinski (*Arch., exp. Path. u. Pharm. Suppl.*, 1908, p. 286) showed that only quantitative differences are involved; under proper conditions of experiments like effects may be obtained with both species of frog. Only the difference in sensitiveness is so pronounced that ordinarily, in the main, according to the species employed, one effect or the other is observed.

Rana esculenta is fourteen times less sensitive than R. temporaria in its muscular reaction towards caffeine. This difference in sensitiveness is certainly striking when we realize that both species are so closely related to each other that eggs of R. esculenta may be successfully fertilized by sperm of R. temporaria.

Owing to the important practical aspect of this subject, I wish briefly and further to emphasize the behavior of European and American frogs towards cardiac poisons. As is well known, digitalis preparations are standardized according to a definite activity on the heart of the frog (*Rana temporaria*). Pico (*Compt. Rendu de la Soc. de Biol.*, 87, 568, 1922), in a checking experiment on an American frog (*Leptodactylus ocellatus*), observed it to be about one hun-

dred times less sensitive towards oubain, stropanthin and digitalein than European frogs, but found no differences in sensitiveness towards saponin and infusion of leaves. A similar behavior is recorded with the European toad (Wieland, *Biochem Z.*, 127, p. 94, 1922). Here, again, we noted quite considerable differences in sensitiveness to poison among closely related animals. Similar differences occurring between animal and man need not cause surprise.

Nevertheless, in the examination of energetic new remedies we naturally cannot dispense with preliminary experimentation on some kinds of animals. However, in general, we may accept that the toxic doses per kg. of animal are never identical with those per kg. of man. This holds good not only for complicated alkaloids with points of attack on some definite, highly differentiated nervous substrata, but also for drugs acting on any living system, as well as for indifferent narcotics of the aliphatic series. We will illustrate by an example.

The lethal dose of *veronal* for rabbits is 0.4 g. per kg. (Jacoby, *Arch. exp. Path. u. Pharm.*, 66, p. 259, 1911); the narcotic dose in rabbits is 0.12 g., in dogs 0.15 g. (Molle and Kleist, *Arch. f. Pharmazie*, 242, p. 401, 1904; Fischer and v. Mering, *Therapie der Gegenwart*, 1903, 97). Calculating these doses for man of 70 kg. weight, the narcotic dose would be 8.4 to 10.5 g., the lethal dose at 21 to 28 g. As a matter of fact, the therapeutic dose is about 0.5 g., the lethal dose 4.5 to 5.0 g. Therefore, the narcotic dose in man is only one-sixteenth, the lethal dose one-fifth of the amount one should expect from the results of experiments on animals. It follows that man is much more sensitive to veronal than the rabbit or dog. The same is true for many narcotics, although not for all.

Urethane, for example, is an excellent narcotic for rabbits, in which doses of 0.5-1.0 g. per kg. cause profound sleep. For dogs urethane is too weak, and in human therapy it failed to gain a foothold, notwithstanding its otherwise excellent qualities, because its effect is too feeble as well as too uncertain. If applicable at all, it is to children's practice. Thus, while rabbits are more resistant towards veronal than man, the reverse is true with urethane, and, again, it is different in the dog.

We might imagine that by increasing the dose of urethane in man we might be able to enforce sleep, but this is only rarely the case, because in large doses stimulant effects become evident in man,

probably due to the amino group in urethane, which directly counteracts the tendency to sleep.

Still more striking are the different effects caused by *trional.* While in man it is a strong narcotic, cats cannot be narcotized with it, on the contrary, the animals become extremely excited and are attacked with pronounced reflex cramps, while rabbits fall into deep narcosis with the same agent (Igersheimer, *Arch. exp. Path. u. Pharm. Suppl.*, p. 285, 1908). The difference in the action of large and small doses of urethane points to a possible explanation of the difference in activity in different animals. Each poison may exert its action at several points of attack, and that which we observe is the resultant (sum or difference) of all these many single effects. A different picture of total effect is observed according to whether in a given kind of animal one point of attack responds more easily than another, or whether the change of a given organic function entails a more or less striking change in the totality of vital manifestations.

Meeting with such distinctions in the use of the indifferent narcotics, in which the narcotic action otherwise by far predominates, it is not surprising that we should encounter similar differences, even to a higher degree, among the more complicated alkaloids.

Different effects are the more readily explained when there is lacking in one kind of animals the anatomical substratum or the functional apparatus upon which, in the other animals, the poison exerts its action. It is well known that many animals, *e. g.*, rabbits, horses, donkeys, young cattle, goats, are unable to vomit, hence it is not surprising that emetics do not have a vomiting effect with these animals. Strangely enough, emetics also in part fail with animals capable of vomiting, *e. g.*, when apomorphine is given to the frog, hog or hedgehog. With the latter, in addition, emetine and cephaeline do not act as emetics (Lewin, *Arch. intern. de Pharmaco-Dynamie,* 11, p. 9, 1902). But the other properties of the emetics are more or less retained, and eventually exert their effects upon these animals more strongly than upon others, since they are unable to rid themselves of the poison by vomiting. This, no doubt, explains the great sensitiveness of horses towards tartar emetic and croton oil.

Furthermore, cases are known in which the physiological substratum is not absent, but is of lesser importance for the total organism. As a result, the end-reaction of the poisonous effect is differ-

ent. Warm-blooded animals die of curare poisoning by paralysis of the muscles of breathing—that is, by suffocation. The frog recovers because he is able to obtain his oxygen supply by breathing through his skin.

In other cases a poisonous effect may be counteracted so that the poison seems to be inert towards that particular animal. This is illustrated by the example mentioned above, in which poisoning by acids in carnivora is neutralized by the generation of alkali through intra-molecular transfer. Another appropriate example was observed by Lauder Brunton ("Text-Book of Pharmacology"). When a rabbit is made to inhale amyl nitrite the blood pressure sinks considerably, while with a dog under the same conditions the decrease in pressure is hardly noticeable. Here, apparently, an entirely different effect presents itself, but analysis shows that the fundamental effect—namely, vascular enlargement—is the same in both animals. Only in the dog the decrease of pressure is compensated by acceleration of the pulse, though the decrease in the tone of the vagus has only weak physiological tonicity, therefore decrease of the tonus has but little effect on the beating of the pulse, hence it is unable to accelerate the heart beats to any considerable extent which would compensate the decrease in pressure. When the vagi are cut in the dog it will behave as the rabbit. Thus we see the effect may be entirely different, notwithstanding the fundamental identity of the cause, and it is not possible to predict which type man will follow or whether new complications may not enter the case to change the picture.

Among the poison-proof animals the hedgehog, since ancient times, has enjoyed a special reputation. It is true that exact investigation has taken from him a part of his fame in this respect. (As a matter of course, he is not absolutely immune to poison.) It is astonishing to note the quantities of otherwise fatal poison that this animal can endure. For example, he is very resistant toward the bite of the common viper, which Lewin was able to confirm through exact experiments (*Dtsch. med. Wochenschr.*, 1898, p. 630).

The best information we have, however, is as regards his behavior towards cantharidin. When it is applied subcutaneously it causes suppuration the same as in other animals, but it is very resistant in regard to renal effects if the poison is applied by mouth or intravenously. Thus it is possible to feed this animal for a long time with large quantities of Spanish flies (30 g. in twenty-four

hours, corresponding to 1/10 g. cantharidin) without bad effects (Horwath, *Dtsch. med. Wochenschr.*, 1898, p. 342 Ellinger, Lewin). Ellinger, furthermore, has established (*Arch. exp. Path. u. Pharm.*, 45, p. 89, 1901) that 1 g. cantharidin is a dose that will sicken the following weights of experimental subjects: Man, 350,-000 kg.; rabbits, 200,000 kg. (when feeding oats); hedgehog, less than 35 kg. One g. cantharidin is the lethal dose for the following weights: Man, 20,000 kg.; rabbits, 500 kg.; hedgehog, 7 kg. Or, calculating this to numbers of individuals, 1 g. of cantharidin will kill about 300 men, 200 rabbits or 10 hedgehogs.

Later (*Münchner med. Wochenschr.*, 1905, No. 8) Ellinger has shown that rabbits may be rendered more resistant by causing the urine to become alkaline through proper food or pre-treatment with alkali. Cantharidin is a lactone which is stable only in acid solution. In alkaline solution it is changed to a di-basic salt which is inert. This result places the resistance of the hedgehog into a still more strange light, since his urine has an acid reaction, owing to his belonging to the carnivora.

Goats are also said to be very resistant towards cantharidin, but no figures are available to bear out this statement. Judged by Ellinger's results, greater resistance is very plausible, since the urine of herbivora always has a strong alkaline reaction.

The goat is likewise very resistant toward another poison, cytisin, which occurs in *Cytisus laburnum, Ulex Europæus,* and many other plants. According to Radziwillowicz (*Arbeitin des Pharmak. Inst., Dorpat,* 1889, under Kobert), the lethal dose per kilogram of animal is: Cats and dogs, 2 to 3 mg. chickens, pigeons, 7 to 9 mg.; goats, 73 mg. It is even stated (Rosenthal, *Heil-Nutz-und Giftpflanzen,* Erlangen, 1862), that in Dalmatia frequent cases of poisoning are said to occur of persons using milk of goats that have eaten food containing cytisin (from *Cytisus Weldeni*). Thus while the goat is not affected, man using goat's milk will become sick with headache, disturbances of the stomach and intestines. In Rome similar cases of poisoning in great numbers have also been observed. We have no recent data concerning this, but there is no reason to doubt these reports. We know that, for example, an infant may become poisoned through its mother's milk if the mother has been treated with morphine. In this case we are confronted with the same species, only with a difference in sensitiveness, dependent upon age.

Very far reaching differences in sensitiveness of different species of animals are also observed toward atropine, which we will now consider a little more in detail, because it is the best known example and because there are several recent reports on the relative immunity of the rabbit towards atropine, which tend to show how complicated often are the conditions with which pharmacologists are involved.

According to Richet (*Dict. de Physiologie*), the several living creatures rank successively as following according to their sensitiveness towards atropine: Man, monkey, cat, dog, rabbit, guinea-pig, rat, goat, pigeon, hog. While most experiments have been conducted on rabbits, this was done for practical reasons, not because the rabbit might be the least sensitive animal, and, therefore, the most appropriate for studies as to resistance. According to Richet's scale, we must keep in mind that experiments on other animals will probably reveal still more striking examples as concerns individual differences in sensitiveness towards the poison.

Human beings become ill after eating three or four berries of *Atropa belladonna,* showing phenomena of central irritation, on account of which the plant received the German name *"Tollkirsche"* (mad cherry). Similar symptoms are seen, for example, in horses after they are fed 120 to 180 g. of the dried herb or 60 to 90 g. of the root. Horses have been killed by eating 180 g. of the root. On the other hand, it has been possible to feed rabbits, guinea-pigs and rats for a long time with the herbs of belladonna and thorn apple. The most detailed experiments on this subject have been conducted by Heckel (*Compt. Rendu de l'Acad. de Paris,* 80, 2, 1875, p. 1608), who succeeded in raising fertile generations of rabbits and guinea-pigs which were fed in summer with fresh leaves of hyoscyamus, belladonna and datura stramonium, and in winter with a mixture of the dried plants and roots. The animals were thriving and rejected other food when they were used to belladonna from birth. Lewin (*Dtsch. med. Wochenschr.,* 1899, p. 37) later conducted similar experiments in which belladonna was merely admixed with the food. He calculated that the animals had taken up in two weeks about 4 g. of atropine, exclusive of the accompanying alkaloids. Thus they received per day 0.3 g.—that is, three times the lethal dose for a full grown man. These are certainly striking examples showing that the results of experiments made upon one living creature cannot be necessarily paralleled by applying the same processes to another.

It has often been asserted that the meat of such animals is poisonous for man. For example, Seels (*New York Med. Record,* 1904, p. 14, quoted after Kobert, "Toxicologie") published a case of fifteen girls becoming ill after eating roast turkey containing atropine. Koppe (*Diss. Dorpat,* 1866) likewise mentions such cases. According to more recent investigations, such assertions cannot be relegated offhand to the domain of fable.

Cloetta, for example (*Arch. f. exp. Path. u. Pharm.,* 64, p. 427, 1911), established the fact that in rabbits accustomed to atropine the discharge of atropine through the urine is finished only after twenty-four hours, and that muscles, in contrast to liver, brain and blood, do not possess the power of destroying atropine.

Heckel was not able to observe any symptoms of atropine poisoning whatever in his animals.

Metzner (*Arch. f. exp. Path. u. Pharm.,* 58, p. 110, 1912), who has probably conducted the most exact feeding experiments, observes the mydriatic effect as the most sensitive test for atropine only *in the beginning.* Later the pupils were normal. For this reason it was all the more surprising that the rabbits reacted towards atropine administered intravenously in the same way as did any other animal—the ends of the cardiac vagus were paralyzed, the pupils were enlarged. Thus it is seen that the mode of application plays a considerable part. The work of Heffter and Fickenwirth (*Biochem. Zeitschrift,* 40, p. 48, 1912) gives a numerical expression of these facts: In normal rabbits the lethal dose per kg. of body weight is 1.4 to 1.5 g. when applied through the stomach, 0.65 to 0.7 g. given subcutaneously, 0.068 to 0.074 g. given intravenously. The ratio of 2 to 1 for the lethal stomachal and subcutaneous doses has also been found with other alkaloids. It is noteworthy that the ratio of the intravenous to the subcutaneous doses is as 1 to 10, while the similar ratios for caffeine and strychnine were found to be 1 to 1 or 1 to 2; quinine, 1 to 7 (Maurel, *Comp. Rendu Soc. de Biol.,* 66, p. 782, 1909).

Taking for comparison a more sensitive animal, we find that for the dog the lethal dose in subcutaneous injection is 0.4 to 0.5, intravenously 0.07. It is striking to note that in intravenous injection the atropine-proof rabbit can not support more of the poison than does the dog. This is explained through the observations of Fleischmann (*Arch. f. exp. Path. u. Pharm.,* 67, p. 518, 1910), who found that

the blood of rabbits has the power of destroying atropine, possibly by saponification through a ferment.

The more slowly the poison is administered to the blood the more completely it will be destroyed. Heffter was able to prove this in rabbits, even upon intravenous injection, by regulating the *rate* of administration. This example shows us the absolutely uncontrollable manner in which injection may influence different species of animals. The mode of application and the rate of administration of the poison may cause enormous errors.

However, only a part of the resistance of the rabbit is explained with certainty by the atropine-destroying power of the blood, for, strangely enough, this ability is developed quite differently in different individuals, although thus far we do not know the cause. And, curiously, such data are missing completely in Metzner's animal material, although it had been fed exclusively with belladonna for a long time.

This example shows the many contradictions yet to be unraveled and difficulties to be overcome. *We shall probably never get to the point of finding a sort of coefficient through which we may be able to transfer the results of animal experimentation to man or other kinds of animals.**

While with atropine the differences in effect were mainly quantitative, we meet in another very important drug, morphine, quantitative as well as qualitative differences in the action upon different animals. The quantitative differences in this case are enormous, regardless of the mode of application, and whether with sensitive or resistant animals. For example, to put a frog weighing 70 g. under light narcosis required 0.02 g. morphine hydrochloride (Barth, *Arch. f. exp. Path. u. Pharm.*, 70, p. 290, 1912), *i. e.*, twice the usual therapeutic dose for man weighing 1000 times as much. The lethal dose for a frog is about 0.5 per kg. A similar low sensitiveness is shown in dogs and rabbits, which a dose of 0.2 to 0.3 g. per kg. will kill; in pigeons this dose is 0.75 to 1 g. (Falk, *Lehrb. d. Toxicologie*). The lethal dose for a grown man is about 0.2 g., *i. e.*, about 1/70 of that for dogs and rabbits.

The symptoms under which man or dog dies on being poisoned by morphine are also totally different. The dog perishes after an initial deep sleep under sudden strychnine-like convulsions, which

*Italics by J. U. L.

occur at intervals, while in man life is extinguished slowly in deep coma through paralysis of the center of respiration. Otherwise, and when non-fatal doses are given, the symptoms in the dog are vomiting and defecation. In especially sensitive humans vomiting as an initial symptom may likewise be observed.

For other animals, Guinard ("La morphine et l'apomorphine," Paris, 1898, quoted by Fröhner) gives the following average toxic dose per kg. of animal: Horse, 7; donkey, 9; young cattle, 15; cat, 40; dog, 65; hog, 200; goat, 400 mg. We see herein quite enormous differences in resistance.

But much more annoying to the experimenting pharmacologist is the fact that effects also differ enormously in qualitative respect, so much so as to lead one to doubt whether they are due to the same poison.

Horses and cattle, and, above all, the cat, show not a trace of narcosis (with morphine); on the contrary, the utmost excitement, often plain frenzy. The animals reacting with excitation also exhibit an opposite mydriatic effect. In man and those animals which respond to morphine with narcosis the narrowing of the pupil may be directly utilized diagnostically; in the cat, the horse and in cattle the pupil is enlarged.

It is very remarkable that cats may be oppositely sensitive at different ages. Although children, as is well known, are much more sensitive to morphine than grown people (the same holds good for young dogs), young cats are able to stand 0.05 g. of morphine, while older cats will die after a dose of 0.04 g. per animal, notwithstanding the larger body weight (Fröhner). Other opium alkaloids, *e. g.*, narcotine (Barth, *Arch. f. exp. Path. u. Pharm.*, 70, p. 290), although of different chemical structure, it is true, act on the cat as soporifics.

In the study of the important morphine derivatives especially, the pharmacologist keenly feels the lack of a suitable animal for experimentation. Of the usual laboratory animals, only the frog and the dog can be considered. Nevertheless, in the search for new remedies it has been the experience that changes in the morphine molecule increase toxicity for one animal while decreasing it for another. The alkyl ethers of morphine, *e. g.*, codeine (methyl-ether), dionin (ethyl-ether), etc., act in the same sense on cold-blooded and warm-blooded animals.

All the more unexepected is the result with ethylene morphine

(v. Mering, *Merck's Jahresber.*, 1898, p. 11). A frog of 70 g. weight, which a dose of 0.02 g. morphine would put into a state of light narcosis, was killed after one hour in a state of profound narcosis by a dose of 0.012 g. of ethylene morphine. On the other hand, the same agent had hardly any effect on rabbits, dog or man. Hence, in the frog there is considerable increase in the toxicity as compared with the fundamental substance; in the dog there is decrease to almost ineffectiveness.

Another example of opposite behavior in man and animals was found by Lewin in Kawa resin (*Dtsch. med. Wochenschr.*, 1898, p. 375). This substance renders the cornea of rabbits insensitive, that of man hyper-sensitive.

There is an entire chapter in pharmacology, that of the action on the uterus, which becomes very difficult to study, owing to difference in behavior in different animals. Ergot preparations are believed to act in a uniformly stimulating sense upon all animals. In other respects there is manifold variety, which is readily understood when we realize that irritation of the same nerves may have different effects in different animals, even in the same animal, depending on the physiological conditions of the organ. According to Langley and Anderson (*Journal of Physiology*, 1895, 19, p. 122), irritation of the *nervus hypogastricus* in the cat first causes repression, then stimulation, of the uterus, while in rabbits stimulation takes place at once. Adrenalin acts as a stimulant in both cases. The pregnant uterus of the cat, however, behaves differently, inasmuch as irritation of the nerve with adrenalin produces stimulation at once (Dale, *Journal of Physiology*, 34, 189, 1906). An example of the effect of adrenalin on the uterus of the guinea-pig shows hows little we are justified in transferring results obtained with the isolated organ to the whole organism. The isolated uterus of the guinea-pig reacts towards adrenalin always by relaxation, but if adrenalin is injected into the animal the uterus will contract *in situ* (Sugimoto, *Arch. f. exp. u. Pharm.*, 74, p. 30, 1913).

*The numerous failures in medical practice with preparations claimed to aid parturition, after they were successfully tested on animals, show that, in these cases especially, the application of results from animal to man should be accepted only with the exercise of the greatest caution.**

*Italics by J. U. L.

As the foregoing examples have demonstrated, the results of experiments on animals cannot be readily applied to man; nevertheless, this fact cannot cast discredit upon experimentation on animals as a scientific method. It remains indispensable and irreplaceable. When the human organism reacts differently, this experience will serve to deepen our knowledge of biological phenomena in general and the human organism in particular. Without the experiment on animals we should be limited to a mere description of the effect on man, and should relinquish the hope of a deeper understanding. But the question whether a new remedy is useful in human therapy or not is an entirely different matter. Here the experiment on animals may lead to valuable preliminary conclusions, but the decisive word on its practical usefulness must come from the clinical practice.

STANDARDIZATION OF VISCOSITY PIPETTES.*

By Emil Gardos.

By measuring the viscosity of mineral oils with various pipettes, the method of the U. S. Pharmacopœia was found to give different results with the same oil. The U. S. P. method for determining the viscosity of liquid petrolatum is the following (U. S. P. IX, p. 315):

> "Make a permanent mark about 2 cm. below the bulb of a 50 cc. pipette of the usual type and note the time in seconds required at 25 degrees C. for the level of the distilled water to fall from the upper to the lower mark as the liquid flows from the burette. The time should not be less than twenty-five seconds nor more than thirty seconds for the pipette selected.
>
> "Draw the liquid petrolatum to be tested in this pipette, which should be clean and dry, and note the time, in seconds, required at 25 degrees C. for its level to fall from the same upper to the lower mark as used for water. Divide the number of seconds thus noted by the number of seconds required for water to fall from the upper to the lower mark, as above determined. The quotient indicates the viscosity. Distilled water 25 degrees C. is taken as 1."

The 50 cc. pipette "of the usual type" does not specify the size and shape of the pipette, which is a very important factor.

*A contribution of the Plaut Research Laboratory of Lehn & Fink, Inc.

Pipettes complying with the U. S. P. specifications gave for the same oil viscosities varying from 3.81 to 12.28 at 25 degrees C. The results of the experiments made with U. S. P. pipettes may be tabulated as follows:

Pipette	Time of Flow for Water at 25° C.	Time of Flow for Heavy Liquid Petrolatum U. S. P. "A" at 25° C.	Viscosity of Heavy Liquid Petrolatum U. S. P. "A" at 25° C.	Time of Flow for Heavy Liquid Petrolatum U. S. P. "B" at 25° C.	Viscosity of Heavy Liquid Petrolatum U. S. P. "B" at 25° C.
A	28.9 sec.	218.3 sec.	7.55	79.6 sec.	2.76
B	25.8	178.8	6.94	66.5	2.58
C	27.2	104.0	3.81	47.	1.73
D	27.6	299.2	10.84	92.	3.33
E	27.6	339.0	12.28	105.	3.80

The chief factors involved in causing the above variations are the pressure of the outflowing liquid, the adhesion of the liquid to

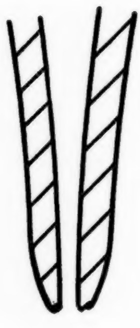

FIG-1

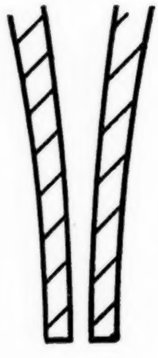

FIG-2

the wall of the pipette, the surface tension of the drop and the friction between the liquid and the wall of the pipette.

The pressure is proportional to the specific gravity of the liquid and to the length of the pipette up to the mark. The error owing to this factor is not great. The same can be said of the adhesion of the outflowing liquid to the wall of the pipette which may reduce the volume of the liquid 1-2 cc. These two factors and the viscosity are in inverse proportion.

The marked variations in the results obtained are owing to the

surface tension of the drops at the end of the pipette and to the friction between the outflowing liquid and the wall of the pipette. The surface tension depends on the size and shape of the bore, while the friction is influenced by the shape of the whole pipette, especially that of the delivery tube. The longer and wider the delivery tube, the greater is the friction and hence the viscosity.

The importance of the size of the bore and the lower stem may be proven by the following experiments:

(1) The bore of pipette C (see first table) was made a little larger (C1); then it was ground to a flat surface like figure No. 2 instead of the normal end, figure 1. This is C2. The viscosities obtained with the three pipettes may be tabulated as follows:

Pipette	Time for Water at 25° C.	Time for Heavy Liquid Petrolatum U. S. P. "A"	Viscosity of Heavy Liquid Petrolatum U. S. P. "A" at 25° C.	Time of Flow for Heavy Liquid Petrolatum U. S. P. "B" at 25° C.	Viscosity of Heavy Liquid Petrolatum U. S. P. "B" at 25° C.
C	27.2 sec.	104, sec.	3.81	47. sec.	1.73
C1	25.	90.5	3.62	41.	1.64
C2	28.	75.5	2.7	41.	1.46

We can see that the viscosity is much reduced by grinding the end of the outlet tube. It is interesting to note that all three pipettes answer the specifications given in the U. S. P.

(2) The lower stem of pipette B was 245 mm. long. After taking the viscosity of the oils, it was cut down to a length of 41 mm. giving pipette B1. Both pipettes are within the U. S. P. limit, which is 30-250 mm. for the delivery tube, therefore both are acceptable for measuring viscosities. Pipette B2 was obtained by grinding the end to a flat surface, like figure No. 2.

The results are the following:

Pipette	Time for Water at 25° C.	Time for Heavy Liquid Petrolatum U. S. P. "A"	Viscosity of Heavy Liquid Petrolatum U. S. P. "A"	Time for Heavy Liquid Petrolatum U. S. P. "B"	Viscosity of Heavy Liquid Petrolatum U. S. P. "B"
B	25.8 sec.	178.8 sec.	6.94	66.5 sec.	2.58
B1	25.1	104.4	4.16	44.3	1.76
B2	30.0	98.3	3.28	47.	1.57

The result shows that by shortening the delivery tube, the viscosity was reduced 40 per cent. in case of petrolatum "A" and 32 per cent. in case of petrolatum "B." On the other hand, by grinding down the end of the pipette to a flat surface (B2) a reduction in viscosity also took place.

In addition to this experiment an exact measurement was made on the five pipettes in question. We do not believe it essential to give these lengths as they do not assist us in explaining the variation obtained.

In conclusion we feel justified in saying that the present U. S. P. method for determining the viscosity of liquid petrolatum is not sufficiently accurate, owing to the very conflicting results obtained by using pipettes the specifications of which satisfy the demands in the U. S. P. In order to get the same results with different pipettes, a standardization of the bulb and stem is needed, giving special attention to the delivery tube and to the bore.

THE SHADES OF THE ALCHEMISTS.*

A one-act sketch with a slightly satirical flavor introducing some interesting alchemistic characters and some others.

Dramatis Personæ—in the Order of Their Appearance.

Carl Wilhelm Scheele ....A Swedish apothecary.
Count Cagliostro ....A scientific mountebank.
Dr. John Dee ....A famous English mystic.
Edward Kelly ....Dee's companion and skryer.
Paracelsus ....A fifteenth Century iconoclast.
Roger Bacon ....A Franciscan brother with scientific learning.
Albertus Magnus ....A Dominican monk interested in alchemy.
Geber ....An Arabian pharmacist and alchemist.
Galen ....A Roman pharmacist and physician.
Hermes Trismegistus ....The Egyptian adept—Founder of the Alchemistic Art.

Time—July, 1780. *Place*—Köping, Sweden.

*By Charles H. LaWall, Ph. M., D. Sc., Dean of Pharmacy, Philadelphia College of Pharmacy and Science, and produced on the stage by a cast composed of students from the Science Classes of the College, under the direction of Mrs. Ada S. Capwell, Assistant Librarian.

The action of the play occurs in the laboratory of Carl Wilhelm Scheele, a Swedish apothecary and chemist. Several work tables full of curious apparatus are seen in the background, also a cupboard or shelf of bottles and jars. A number of chairs are scattered around the laboratory, in one of which Scheele is seen seated, poring over a ponderous and ancient book lying open on a table before him. A letter is lying open on the table beside him, and writing materials are at hand.

SCHEELE (soliloquising and holding a glass tube in his hand tightly stoppered and containing a volatile liquid):

"This then is the subtle fluid of death which yesterday near claimed its earliest victim in myself. The Prussian Blue so harmless holds concealed this deadly dose which men may use in future time for weal or woe. Shall I unfold its mystery to the world or, by concealing, gain more peace of mind?

(Places tube in crude holder on table before him and continues soliloquy).

"When I with 'black magnesia' tried my art, two wondrous new materials came to light. The one, that air which Priestley also found and gained the Kudos too, because my treatise 'Air and Fire' was held from print too long. I called it 'empyreal air' nor dared to use that ugly word Van Helmont gave the world, 'Gas.' What an ugly sound. Methinks the world will never learn its use. And Priestley following Stahl, has called it dephlogisticated air. Then, too, the greenish yellow air that came from black magnesia when with muriatic acid it was boiled, this lacked phlogiston too, so it I called the dephlogisticated muriatic acid. It is a wondrous bleach and active too with metals.

"Ah! I have the answer now. I'll tell the world the secret of the Prussian Blue and how its color is imparted by this limpid stuff, but not a word about its deadly trait. I half believe the toxic potion of the peach, far famed in old Egyptian lore is this same thing which I hold here." (Takes the tube up and looks at it curiously.)

A knock is heard at the door of the laboratory. Scheele arises, still holding the tube of poison in his hand, goes to the door and says: "Who's there?"

A voice from without says: "One who came from distant lands to meet the far-famed pharmacist of Köping."

SCHEELE: "Enter then and state thy mission."

Enter Cagliostro. He stands opposite Scheele in silence for a few moments, and then says: "Hail, master of our ancient art, I came to crave a boon."

SCHEELE: "I am master of no art, but a humble pharmacist earning an honest living and trying in odd times to learn the mysteries of matter. But what boon is it you crave of me? And who are you?"

CAGLIOSTRO: "I am Cagliostro, The Transcendentalist of Egypt, England, Russia, France."

SCHEELE: "Yet I know you not, what are you?"

CAGLIOSTRO (aside): "Such is fame," to Scheele. "I am an adept. I hold the gifts of life and wealth."

SCHEELE (aside, and looking at the tube which he holds in his hand): "And I the gift of death." To Cagliostro: "What mean you by the gifts of life and wealth?"

CAGLIOSTRO: "I am the possessor of the philosopher's stone and have successfully transmuted baser metals into gold for my friend and patron Cardinal Rohan. I also hold the formula for the wine of Egypt, which confers upon its possessor the power of sloughing off the years as a snake sheds its skin."

SCHEELE (aside): "I ne'er believed these tales, but thought them only idle dreams, I must learn more concerning these wondrous things." To Cagliostro: "If you possess such rare gifts why do you seek the humble apothecary of Köping?"

CAGLIOSTRO: "The reason therefor is not hard to explain. I had among my clients a wealthy dame who wished to regain her youth. I gave into her keeping my entire stock of the famous wine of Egypt. She was to take it carefully in two drop doses each night beginning when the moon entered its last quarter. Whilst waiting for the period to arrive she placed the vial in her wardrobe and told her maid it was a remedy for colic. The precaution was fatal to her plan. By a singular coincidence the maid was seized the following night with the same affliction of which her mistress had spoken. Remembering the remedy so conveniently at hand, she searched for it in the dark and finding it, emptied the vial at a draught."

SCHEELE (interrupting): "And died forthwith?"

CAGLIOSTRO: "Nay, but in her place when the mistress called when morning came, they found her not but found a prattling cooing babe."

SCHEELE: "And none suspected?"

CAGLIOSTRO: "None but I. And I durst not replenish my stock of the elixir from sources near at hand, for spies watch my purchases and I was forced to make this journey to a distant land, and came to you as one of probity and good faith who could keep my secret."

SCHEELE: "You do me honor, indeed, but what is this wondrous ingredient for which you came so far?"

CAGLIOSTRO: "I dare not speak the name aloud." (Whispers in Scheele's ear.) Scheele starts in surprise, and then says: "What? so common a substance as that to possess such marvelous properties?"

CAGLIOSTRO: "Yes, indeed, when properly prepared by my occult skill, and I know thy fame for purifying rare drugs, and have come to thee for a supply of the best of this substance that thou hast."

Scheele goes to a cupboard, takes from a drawer an empty vial, reaches within the cupboard for a bottle and pours therefrom a liquid of golden hue, fills the vial, stoppers it and hands it to Cagliostro, who holds the bottle up to light, looks, at it and says, aside: "Wonderful essence of potency profound, not yet available but latent." To Scheele: "I thank thee warmly and will pay thee well." (Reaches for his purse.)

SCHEELE: "Pay me not in gold but in service."

CAGLIOSTRO: "What wouldst thou?"

SCHEELE: "Not wealth, nor yet eternal youth, but a glimpse of thy occult power."

CAGLIOSTRO: "Wouldst thou meet the Alchemist Shades of ages past?"

SCHEELE: "Fain would I and others too of high repute, if that were possible."

CAGLIOSTRO: "Name those whom thou wouldst meet and I will summon them."

SCHEELE: "There are a few o'er whose writing I have pondered and gained much profit. There was one called Theophrastus Bombastus who is better known as Paracelsus."

CAGLIOSTRO: "Thou shalt see him e'er the hour is past—and who else is there?"

SCHEELE: "The Venerable Dee and his skryer, Edward Kelly."

CAGLIOSTRO: "Are there others?"

SCHEELE: "The two ecclesiastics, Roger Bacon and Albertus Magnus."

CAGLIOSTRO: "Are these all?"

SCHEELE: "The Arab Geber and the Roman Galen, too, I would fain see and hold some converse with."

CAGLIOSTRO: "They shall all be with us in the twinkling of an eye." Walks across to table, picks up therefrom a crucible, takes from his pocket a vial of powder, pours some in the crucible and takes a bottle from the table and pours a few drops of the liquid into the crucible. A brilliant flash occurs, accompanied by a cloud of smoke and immediately there appear upon the stage the following characters:

Paracelsus	Roger Bacon
John Dee	Albertus Magnus
Edward Kelly	Geber

Galen

All salute Cagliostro—not formally—but airily and flippantly and then separate into groups, laughing and talking.

Paracelsus goes up to Cagliostro—slaps him on the back affectionately and says: "Well, Cal, how's the boy today." Aside to the others: "Funny place to bring us, isn't it?" Again, to Cagliostro: "Well, Cal, what's on your mind?

CAGLIOSTRO (to Paracelsus): "A friend of mine asked the privilege of meeting you and so I sent for you."

PARACELSUS: "Well, you picked a very inconvenient time. Some of the boys were just going to sit down to a little game, and Eddie here (placing his hand on Kelly's shoulder), and I were going out to play a round of golf."

CAGLIOSTRO (to Scheele): "Well, here they are, look them over, and ask them anything you like."

SCHEELE (who has looked bewildered ever since the shades first arrived, stammers): "But—I don't understand. Why are they so undignified and what does he mean by a little game and what is golf?"

CAGLIOSTRO: "Well, you see not being a member of the Ultra-Stygian Country Club you are unable to comprehend some very simple facts. These friends are upon a plane where there is neither time nor space."

SCHEELE (astonished): "Neither time nor space?"

CAGLIOSTRO: "That's what I said, and in consequence of that fact, they are able to appear in any place and at any time."

SCHEELE: "What, even in the future?"

CAGLIOSTRO (dropping all of his former formality): "Sure. It's like this, they know all that has been and all that is to be. This little game to which they refer is a game called poker which hasn't been invented yet. And golf is a game which only the Scotch play in your time, but which is very popular in the Nineteenth and Twentieth Centuries, where they spend part of their leisure."

SCHEELE: "Marvelous! And what do they do in their leisure?"

CAGLIOSTRO: "Oh! They roam about the world, seeing things of interest when they are not at home resting."

SCHEELE: "What is this club of which you spoke—'Ultra-Stygian,' I think you said?

CAGLIOSTRO: "Yes, that is the favored club during the summer. There is also the 'Infra-Elysian' Yacht Club. They just had quite a contest there over the election of a commodore. The contestants were Noah and Columbus."

SCHEELE: "And who was the victor?"

CAGLIOSTRO: "Neither—a dark horse candidate named Neptune came out first."

SCHEELE: "And do they naught but enjoy themselves?"

CAGLIOSTRO: "Oh! No! They inspire many discoveries and are always looking for a chance to aid the worthy devotee of science. You, yourself have been helped by them more than once, although you knew it not."

CAGLIOSTRO (to assembled shades): "Let us show him a few of the discoveries of the next hundred and fifty years."

ALBERTUS MAGNUS (looking around as if searching for someone): "Where's Hermie?" (Other shades, also looking about): "Yes! Where's Hermie?"

CAGLIOSTRO (to shades): "Why our friend here did not include him in his party." (Several shades, petulantly): "We can't do anything without Hermie."

SCHEELE (to Cagliostro): "Whom do they mean by Hermie?"

CAGLIOSTRO: "The father of our art, Hermes, thrice-greatest of Ancient Egypt, called Hermes Trismegistus by you mortals."

SCHEELE: "Merciful Heavens, what familiarity!"

ROGER BACON: "When we left, I saw him in the corner of the card room playing solitaire."

EDWARD KELLY: "Call him up, Jack, and see if he can come."

JOHN DEE (reaching under his robe and getting out a telephone headset which he adjusts to his ears and a transmitter which he holds in a position for talking). Turns to the other shades and says: "Now, you fellows keep quiet a minute until I get through talking to him." Speaks through telephone: "Is that you, Homer?"

CAGLIOSTRO (to Scheele): "Homer is the doorkeeper of the Club, they gave him the job because he was blind and when the members' wives call up for their husbands he can always answer that 'he hasn't seen him today.' "

JOHN DEE (continuing telephone conversation): "Is Hermie there?" (A pause.) "Yes, I know you haven't seen him today, but this is Dee speaking and we want Hermie right away."

(Another pause.) Incredulously "He is?"

(Turns to others): "Homer says that Hermie is in the music room turning Nero's music. Nero just received a new piece from the Twentieth Century called 'Red Hot Mamma,' and the title reminds him of his days in Rome."

GEBER: "Tell him to get Bach to turn the music for him. He was out on the porch playing one of Strawinsky's pieces on the mouth organ, when I saw him last." (To Cagliostro): "You know he is trying to play Twentieth Century music, too."

DEE: "Is that you, Hermie? Come right up. The boys are all here, and we want to pull a few stunts for Scheele.'

(Continuing after a pause): "Oh! yes, you know who I mean. He is that Swede that we have all been helping lately, by visiting him while he slept and telling him what to do next."

GALEN: "Tell him to hurry up, we want to get back as soon as possible ourselves. I have a date with Cleopatra after lunch. You know she has opened a beauty parlor and is trying out some of that new ointment of mine that is an improvement over the cold cream that I invented when I was Physician to the School of Gladiators at Pergamos."

EDWARD KELLY: "Oh, shut up, old Paradoxologos. You are always reminding us of that cold cream. You'll get what's coming to you some day—they'll name a Pharmaceutical Society after you."

All turn toward rear entrance, exclaiming: "Here comes Hermie, now!"

Enter Hermes Trismegistus on roller skates.

HERMES: "Well, fellows, what's up?"

CAGLIOSTRO: "Scheele here, wants to see some of the improvements and discoveries that are going to take place after his death."

SCHEELE (aside): "This terrifies me, but I cannot now withdraw."

ALBERTUS MAGNUS (to Roger Bacon): "Show him some of the latest things in high explosives, Roger, like T. N. T. and some of the things they are going to use in the World War."

BACON: "It's too dangerous here, you know we tried that some time ago in the laboratory of that alchemist at Prague, and they never found either the alchemist or the laboratory again. Why don't you do something yourself?"

ALBERTUS MAGNUS (producing a friction lighter): "Perhaps he would be interested in this." (Pours a little ether into a glass vessel and sets fire to the vapor with the friction lighter.) "How is that?"

SCHEELE: "Wonderful. I recognize the odor of the liquid as that of ether vitriolicus, but how did he produce the flame so magically."

PARACELSUS (disgustedly): "Say, you fellows have no sense, don't you know that this poor boob never even saw a safety match or any kind of a match and here you show him a friction lighter which comes much later chronologically."

(Takes a box of Swedish safety matches from his pocket and strikes one, and lights a candle which is on the table in a candlestick.)

SCHEELE: "Can I believe my senses?"

PARACELSUS (handing Scheele the box of matches): "Here, try one yourself." (Scheele takes box very cautiously, and reads the label. His face lights up as he recognizes a Swedish name. He clumsily tries to light one of the matches by imitating the motions of Paracelsus who has just done it. He makes three unsuccessful attempts, the sticks breaking in every case.)

ALBERTUS MAGNUS (to Paracelsus): "They seem to be poorer than usual."

PARACELSUS: "Yes, they used to split every third stick, so it would break, now they split fifty per cent. of them."

Scheele in the meantime has succeeded in striking one of the matches and holds it in admiration until it burns so close to his fingers as to scorch them and make him drop it with an exclamation of pain.

PARACELSUS (to Hermes Trismegistus): "Now, you show him your plaything, Hermie."

Hermes draws forth a flashlight, presses the button and hands the light to Scheele. He very gingerly receives it and handles it with caution as though he expected it to be hot, and finding it is not he flourishes it around and then saying—"Now, I can find that book that I have so long sought in the dark closet." Disappears for a few moments into a back room, returning with a large volume. He remains in the background looking at the shades in a bewildered manner. In the meantime several of the shades have been conversing eagerly together, looking around occasionally at the miserable equipment of the laboratory.

GEBER (to the others): "Say, it looks as though this poor fellow needed some financial help. How about making a 'projection' for him?"

GALEN: "Good, you go ahead and do it, Geber."

GEBER: "I can't do it today. I lent my supply to Henry Ford to use in 1925. He needs some money to finance an improvement on his new model, and Wall Street won't lend it to him."

CAGLIOSTRO: "What is the improvement, Geber?"

GEBER: "He intends putting out a collegiate model."

CAGLIOSTRO: "What kind of a model is that?"

GEBER: "One with lots of pep but no sense of direction. This one can't be steered at all, not even from the back seat."

GALEN: "Well, Roger, I guess you will have to do the honors this time."

BACON: "All right, anything to save time. I hate to use any of my supply for I intend going to Atlantic City to stay at one of the beach front hotels for a few days, and I am afraid that I will need some ready funds. I just borrowed a million from Croesus yesterday, but I don't believe that will reach."

(Bacon goes to table, picks up a crucible. Asks Scheele for some lead which is given to him in silence. Puts in several large pieces. Sprinkles a little powder in it from a vial which he takes from the inner recesses of his robe, carries the crucible to a furnace in the

back of the room, places it therein. All stand in expectation for a moment, Bacon then goes to the furnace, takes out the crucible and carrying it over to the table turns it upside down when a large lump of gold falls out of it and onto the table with a loud crash.)

SHADES: "A fine job, Roger, You never did better in your life."

SCHEELE (approaches the lump of gold reverently, touches it with evident admiration, and then heaving a sigh, says): "And I thought I was a chemist."

CAGLIOSTRO: "Never mind, old man. You have done very well. This kind of stuff is only for show, anyhow. If mankind ever learned to do this civilization would go to smash in a day for all values would be wiped out overnight. Is there anything else that you want before we go? Some of the boys are in a hurry, you know."

SCHEELE: "If I could only see into this future from which you have drawn these wonders."

PARACELSUS (to Dee and Kelly): "Here Jack and Eddy, can't you do your stuff for Fritz, here?"

DEE AND KELLY: "Certainly." (Motion Scheele to approach. Places his crystal ball on the table. Kelly and Scheele both draw near. The other shades surround them.)

DEE (Seats himself, passes his hands mysteriously over the sphere): "Now, what do you want to see?"

SCHEELE: "I do not know want to ask, to look into the future appals me, and yet I fain would do it."

GALEN: "Show him something in the Pharmaceutical line, Jack. That will please him."

DEE: "How would you like to see the first College of Pharmacy in the United States?"

SCHEELE: "What mean you by United States?"

ALBERTUS MAGNUS: "It is that group of states which just a few years since threw off the English rule. You probably know them as the American colonies."

SCHEELE: "And are they destined to become so great?"

DEE: "So the future history records. A melting pot for those of divers lands. They are to accomplish great things in the Nineteenth and Twentieth Centuries."

SCHEELE: "And where in this great new land is this college of pharmacy to be established?"

GALEN: "In Philadelphia, where the sturdy Quakers ever uphold

the principles of right and turn them into paths of progress." (Dee passes his hands over the sphere.)

SCHEELE (peering into crystal ball): "I see a group of men in plain clothes and wearing broad brimmed hats, in a meeting place."

GALEN: "I being a fellow pharmacist will interpret for you. What you see is the meeting of the Founders of the First College of Pharmacy in the new World. The Philadelphia College of Apothecaries, founded February 23d, 1821. It is in a place called 'Carpenters Hall' in Philadelphia."

SCHEELE: "I see now a building in which a few earnest students are eagerly listening to a teacher who speaks as one having knowledge and authority."

GALEN: "You see aright, for this is Dr. George B. Wood, the famous Philadelphia physician and author, delivering a lecture to the first class in the college."

SCHEELE: "The scene changes. I now see a larger group of students, earnest as before, the lecturer is a man with a kindly mien and wears a long black beard."

GALEN: "That is Professor William Procter, Jr., later to be called the father of American Pharmacy."

SCHEELE: "Again I see a different scene. This is not a lecture hall, but is a meeting room. In it are seated three men. The one seemingly in authority is a tall man with oval face, high cheek bones and wears a beard and mustache. Another, and a younger man wears a full dark bushy beard. The third still younger wears but a mustache."

GALEN: "That is Maisch, Remington and Sadtler—the three great men of their day in their respective fields, holding a conference over final examinations."

SCHEELE: "Before you show me more of this great college, let me see a pharmacy of the future."

DEE: "Look closely, here is one of 1924."

SCHEELE (looking into the crystal ball and then looking about in a bewildered fashion): "I see a glittering array of unfamiliar wares but where are the drugs, and where is the laboratory?"

GALEN: "Drugs have small place in the pharmacy of that far distant time, and large laboratories take the place of the smaller ones of your time, and yet the service to mankind is just as great as ever even though not so evident to one who only sees the surface."

SCHEELE (looking again into the crystal ball): "Look! There comes some affrighted woman in dire distress, see how scantily she's clad and how her face is bleeding."

GALEN: "She is not in dire distress, that raiment is the current style and the red gash in her face is her mouth which has been adorned with what the moderns of her age will call a lipstick."

SCHEELE: "Heaven forbid that I should ever live in such a shameless period. I am well content where I am, but what are those shrieks and that ungodly din which I heard as she entered the store."

GALEN: "Oh! That was not an ungodly din, but one of the jazz phonographic records of that bewildering period, which the junior clerk has just put on to demonstrate to a patron."

SCHEELE: "These scenes shock and yet they fascinate me. Would that I could see more of that far off future time so different from our own."

CAGLIOSTRO (aside to Galen): "Perhaps he would be interested in seeing some of the methods of traveling that have developed since the stage coach days of his time."

GALEN (pointing to the crystal): "Here are an airplane, an automobile, a railway train and a steamboat."

SCHEELE (starting back affrightedly): "But these are miracles surely. Such privileges could not be granted to mortals as the enjoyment of these wonders?"

GALEN: "On the contrary, they are all developed from that nucleus of scientific knowledge which in your age is conserved and amplified, but not developed."

SCHEELE: "But how do the common people ride in the cities and towns?"

SCHEELE: "In what are called trolley cars. Here is one" (points to the crystal ball).

SCHEELE: "What a queer looking coach and without horses, too. But why are all of the men seated and the women standing?"

GALEN: "The men of that advanced age are mostly 'Shieks,' he-men, or red-blooded go-getters, who could not demean themselves by showing politeness to a lady."

SCHEELE: "Show me no more of such a barbarous race. With all their scientific advancement, I like them not."

(A commotion is heard without. A voice calls loudly: "Hurry up, Hermie, Jack, Al, and the rest of you. Nero has had a relapse

and has set the clubhouse afire, and is sitting out on the lawn playing 'A Hot Time in the Old Town Tonight.' ")

(All shades quickly leave, Cagliostro and Scheele remain behind alone.)

CAGLIOSTRO: "Well, my friend, and has thou heard and seen enough?"

SCHEELE: "Enough and more. But are these things really so or have I dreamed?"

CAGLIOSTRO: "All that thou has seen and heard is but a small proportion of the wonder and the terrors held in store for those who are to come in future years."

SCHEELE: "With all these marvels, surely the people of that fortunate day will be wiser, kinder, better than we are."

CAGLIOSTRO: "Believe it not. The more men have the more they want. These are but material benefits which, alas, carry with them no increased appreciation of their spiritual worth."

SCHEELE: "And pharmacy, when will pharmacy come into her rightful field of service and appreciation?"

CAGLIOSTRO: "In that time when pharmacists will think as much of their profession as they think of selfish interest. When associations instead of asking for members will have a waiting list, from which to choose the best. When colleges instead of having to beg for money will only take from those whose motive in giving is altruistic and sincere."

SCHEELE: "I fear that time may never come."

CAGLIOSTRO: "Nay fear not so, 'tis in the future writ that this and more shall come to pass."

SCHEELE: "I am content then. But these intriguing scenes have left me with a strong desire to join that happy group that just departed."

CAGLIOSTRO: "And so you shall and that right soon, for I can tell you this, that you were but recently elected an active member of the Ultra-Stygian Club, and e'er another decade will be with us."

SCHEELE: "Thanks! Thanks! I would it were tonight."

(Cagliostro departs and Scheele sinks back into a chair and appears to be in profound reverie.)

(Curtain.)

ACCURACY OF HYPODERMIC TABLETS.*

Within the last few years the Bureau of Chemistry, in the enforcement of the food and drugs act, has given particular attention to medicinal tablets, especially the more commonly used hypodermic tablets. The data thus collected show that most tablets on the market comply reasonably well with the compositions declared. A material number, however, were found to vary from the stated compositions by amounts in excess of what should be expected under properly controlled conditions of manufacture.

These preparations are of prime importance medicinally. They are manufactured from physiologically potent substances and constitute the chief dependence of the physician in emergencies. The physical characteristics of a hypodermic tablet usually furnish no information as to its quantitative composition. Physicians, druggists, and patients must rely upon the label. Serious consequences may follow any misstatement.

The Bureau of Chemistry will regard as adulterated or misbranded, or both, those hypodermic tablets which fail to comply with declared compositions to an extent greater than occurs in such tablets manufactured under properly controlled processes. In ascertaining the degree of accuracy practicable careful consideration will be given to the conclusions of committees representing the drug manufacturing industry which have studied this question thoroughly and have presented a comprehensive report to the Bureau of Chemistry. These committees have suggested the maximum variations, either above or below the labeled or claimed amounts (including all tolerances), which in their opinion should be permitted in tablets manufactured under properly controlled processes. They are as follows:

	Per cent.
Atropine sulfate hypodermic tablets purporting to contain 1/4 gr. or more	7.5
Atropine sulfate hypodermic tablets purporting to contain less than 1/4 gr.	9.0
Cocaine hydrochloride hypodermic tablets	9.0
Codeine sulfate hypodermic tablets	9.0

*A proposed announcement of the United States Bureau of Chemistry.

	Per cent.
Morphine sulfate hypodermic tablets	7.5
Strychnine sulfate hypodermic tablets purporting to contain ¼ gr. or more	7.5
Strychnine sulfate hypodermic tablets purporting to contain less than ¼ gr.	9.0
Strychnine nitrate hypodermic tablets purporting to contain ¼ gr. or more	7.5
Strychnine nitrate hypodermic tablets purporting to contain less than ¼ gr.	9.0

Methods of Analysis Recommended by Committees Representing the Industry.

The committees representing the manufacturing industry recommend the following methods of analysis of the products mentioned above. The Bureau of Chemistry, for the analysis of official samples, employs methods based upon the same general principles as those given below, although some of the details of the procedures may vary somewhat. Studies of these methods show that they give results which agree satisfactorily with those used by the Bureau of Chemistry.

These methods have been referred to the referee on drugs of the Association of Official Agricultural Chemists for his consideration or further study by that association.

Hypodermic Tablets—Atropine Sulfate.

In the case of tablets containing one-twentieth grain of atropine sulfate or in excess of this amount, dissolve at least twenty tablets in sufficient distilled water to make 100 cubic centimeters and take an aliquot equal to at least one grain of atropine sulfate.

In case of tablets containing less than one-twentieth grain of atropine sulfate, dissolve a sufficient number to represent at least one grain of atropine sulfate in sufficient distilled water to make a clear solution.

In either case make the aqueous solution distinctly alkaline with ammonia and shake out with several portions of chloroform until tests with Mayer's reagent indicate that the aqueous solution has been completely exhausted of the alkaloid. Evaporate the combined chloroform extracts to dryness on the water bath. Dissolve the

residue in a few cubic centimeters of neutral alcohol. Add 10 cubic centimeters of N/20 sulfuric acid and titrate excess of acid with N/50 potassium hydroxide solution, using methyl red indicator.

Each cubic centimeter of N/20 sulfuric acid consumed corresponds to 0.017362 gram of atropine sulfate, $(C_{17}H_{23}O_3N)_2H_2SO_4 + H_2O$.

Hypodermic Tablets—Cocaine Hydrochloride.

Dissolve not less than twenty tablets in sufficient distilled water to make 100 cubic centimeters and take an aliquot equivalent to at least one grain of cocaine hydrochloride. Make the aqueous solution slightly alkaline with ammonia and shake out with several portions of ether until the aqueous layer is shown to be completely exhausted of alkaloid, using Mayer's reagent for the test. Combine the ether extracts and evaporate the major portion of the ether on the steam bath, finally allowing the remainder to be dissipated at room temperature. Dissolve the residue in a few cubic centimeters of neutral alcohol. Add 10 cubic centimeters of N/20 sulfuric acid, and titrate the excess of acid with N/50 potassium hydroxide, using methyl red indicator. Each cubic centimeter of N/20 sulfuric acid corresponds to 0.016983 gram of cocaine hydrochloride, $C_{17}H_{21}O_4NHCl$.

Hypodermic Tablets—Codeine Sulfate.

Dissolve not less than twenty tablets in sufficient distilled water to make 100 cubic centimeters and take an aliquot equivalent to at least one grain of codeine sulfate. Make the aqueous solution alkaline with ammonia and shake out with several portions of chloroform until the aqueous solution is shown to be exhausted of alkaloid, using Mayer's reagent for the test. Evaporate the combined chloroform extracts to dryness on the water bath, and dissolve the residue in a few cubic centimeters of neutral alcohol. Add 10 cubic centimeters of N/20 sulfuric acid and titrate the excess of acid with N/50 potassium hydroxide solution, using methyl red indicator.

Each cubic centimeter of N/20 sulfuric acid consumed corresponds to 0.019663 gram of codeine sulfate, $(C_{18}H_{21}O_3N)_2H_2SO_4 + 5H_2O$.

Hypodermic Tablets—Morphine Sulfate.

Dissolve not less than twenty tablets in sufficient distilled water to make 100 cubic centimeters. and take an aliquot equivalent to at least one grain of morphine sulfate. Make the aqueous solution slightly alkaline with ammonia and shake out six times with a mixture consisting of three parts of chloroform and one part of alcohol.

Evaporate the combined extracts to dryness on the water bath and dissolve the residue in a few cubic centimeters of neutral alcohol. Add 10 cubic centimeters of N/20 sulfuric acid and titrate the excess of acid with N/50 potassium hydroxide.

Each cubic centimeter of N/20 sulfuric acid corresponds to 0.018962 gram of morphine sulfate, $(C_{17}H_{19}O_3N)_2H_2SO_4 + 5H_2O$.

Hypodermic Tablets—Strychnine Sulfate or Strychnine Nitrate.

In case of tablets containing 1/20 grain of strychnine sulfate or strychnine nitrate or in excess of this amount, dissolve at least twenty tablets in sufficient distilled water to make 100 cubic centimeters and take an aliquot equal to at least one grain of strychnine sulfate or strychnine nitrate.

In case of tablets containing less than 1/20 grain, dissolve a sufficient number to represent at least one grain of strychnine sulfate or strychnine nitrate in sufficient distilled water to make a clear solution.

In either case make the aqueous solution distinctly alkaline with ammonia and shake out with several portions of chloroform until tests with Mayer's reagent indicate that the aqueous solution has been completely exhausted of the alkaloid. Evaporate the combined chloroform extracts to dryness on the water bath. Dissolve the residue in a few cubic centimeters of neutral alcohol. Add 10 cubic centimeters of N/20 sulfuric acid and titrate the excess of acid with N/50 potassium hydroxide solution, using methyl red indicator.

Each cubic centimeter of N/20 sulfuric acid consumed corresponds to 0.021414 gram of strychnine sulfate, $(C_{21}H_{22}O_2N_2)$ $2H_2SO_4 + 5H_2O$, or 0.01986 gram of strychnine nitrate, $C_{21}H_{22}$ $O_2N_2HNO_3$.

THE ONE HUNDRED AND SECOND ANNUAL COMMENCEMENT OF THE PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE.

The one hundred and second annual commencement of the Philadelphia College of Pharmacy and Science was held on Wednesday, June 10th, at 10 A. M., in the Academy of Music, in the presence of a large audience. Invocation was offered by the Rev. Joseph B. C. Mackie, D. D. John Frederick Lewis, LL. D., President of the Academy of Fine Arts, writer, and orator, delivered a most scholarly and convincing address, which we are fortunate in being able to publish in a later issue of this journal.

Dean Charles H. LaWall, and J. W. Sturmer, Dean of Science, presented the candidates, and the President of the College, Admiral William C. Braisted, conferred the degrees.

The following received the degree of Master of Pharmacy, Honoris Causa: Henry A. B. Dunning, of Baltimore, a scientific pharmacist and manufacturer of wide reputation and the Chairman of the Committee in Charge of the Campaign for the Pharmacy Headquarters; Charles F. Kramer, of Harrisburg, who has served with distinction as a member of the Pennsylvania Board of Pharmacy; William P. Porterfield, of North Dakota, a member of the legislature of his state, and a pharmacist of renown; Joseph Rosin, of Philadelphia, a chemist who has rendered conspicuous services in connection with pharmacopœial revision; and Edward V. Sheely, a distinguished pharmacist of Memphis, Tennessee, and a member of the Board of Pharmacy of his home state.

Degrees in course were conferred upon candidates who had completed the four-year course leading to Bachelor of Science, upon candidates who had qualified in graduate work for Pharmaceutical Chemist or for Bachelor in Pharmacy, and upon a large group who had completed the course leading to Graduate in Pharmacy. The list is as follows:

Bachelor of Science in Pharmacy (B. Sc.)

Isidore DiSalvo	John Hampton Hoch	Raymond Joseph Quigley
Herbert Martin Emig	Paul Francis Lalley	

Bachelor of Science in Chemistry (B. Sc.)

Paul Quinnel Card	Frank McGowan	George Wesley Perkins

Bachelor of Science in Bacteriology (B. Sc.)

Charles Russell Lowe
William Kurtz Perry
Asa Neiley Stevens

Bachelor in Pharmacy (Phar. B.)

Harry Bernard Dressler
Sidney Ellman
John Eugene Frankfurt
Guerch Hornik
Paul Himmelberger
Helen Foerstner Moyer
Adeline Myers
John Joseph Roney

Pharmaceutical Chemist (Ph. C.)

Henry John Brown
Herbert Carlyle Dixon
William Randolph Mc-Creary
George Nock Malpass
Wilbur Nicholas O'Brien
Hanford Eugene Pol-hemus

Graduate in Pharmacy (Ph. G.)

Charles M. Abbott
Aleck Ackerman
James H. Adams
Israel Alexander
Irving Isidore Alpert
Robert T. Anderson
Fred Bruce Appleby
Samuel Edward Arch
Frank A. Augusta, Jr.
Adolfo E. Autrey
William T. Axline
Charles Balaban
Maurice Barr
Daniel E. Bause
Clyde Ott Benner
Abraham E. Benus
Leo A. Berezin
Freda Louise Berger
Harold A. Berman
Boies Barner Berry
Edwin Bird
Hercules J. Biscontine
Henry Blitzstein
Jacob Joseph Bloch
Charles J. Boyle
Benjamin Branhut
Clifford Lee Brendle
Sadie Brisgol
George L. Brooks
Joseph W. Brooks, Jr.
Charles D. Buchanan
Harold Wm. Care
Lemuel F. Carpenter
John Joseph Carter
Joseph H. Carter
Fred A. P. Cashman
Cathleen L. Cawley
Susan Cawley
John Chervenak
Theodore C. Chidester
Joseph L. Clement
Charles Cohen
Francis G. Collins
John Louis Connolly
Ella Bates Cook
Frank Earl Coplan
Joseph J. Costa
Malcolm Wm. Cox
Abraham M. Cutler
Orville E. Deibler
Chas T. LeLorme, Jr.
John Henry Dimke
Helen E. Durkin
Martin Joseph Dwyer
Ray Marks Eberly
Charles E. Edwards
Earl Desmond Evans
James J. Farrell
Bernard Fishkin
Robert M. A. Ford
Philip Freedman
Elias W. Friedman
Regina M. Gallagher
Norman Gartman
Zelman Girzel
Bernard R. Glaser
James E. Golden
Louis Carl Goldman
Harry M. Gottfried
John Gould
Louis Green
Nathan Green
Carmine S. Grieco
Paul Richard Groves
Frank H. Hagadorn
Daniel Harold Hahn
Harry J. Haines, Jr.
Harold E. Hammond
Wayne S. Harris
Herbert Helems Hart
Richard C. Hause
Louis Hauser
Raymond J. Heindle
Bruce P. Hoffman
Charles Hoffman
John Lee Hogan
Michael P. Hopkins
Pauline Hornik
Louis Horvitz
Thomas F. Hynes

Thomas Leroy Ickes
Nathaniel Jacobson
Earl Mathias Jenson
Francis J. Jorczak
Freda Kaigh
Andrew T. Kashuba
Louis Katinsky
Morton L. Katz
Harry M. Kauffman
Julius Kazan
Richard Leroy Kelley
Mary Marcella Kelly
Ralph George Kern
William F. Kirwan
Robert Walter Kline
Lester Elmer Koehler
Joseph S. Kondor
John E. Kramer
Harry Z. Kroser
William Kurland
John George Lamb
Samuel Harry Landy
Eugene Ospen Lawall
Hans Letsche
Charles Levin
Benjamin B. Levinson
John Bacon Lewis
Abraham M. Liebman
Joseph Liesner
John R. Lindsey
Leo Lipkin
Leon Solot Liss
Harry Loevner
Bertha E. Ludwig
John Wilbur Lutz
Dufferin McConnell
C. S. McDannald
Edwin P. MacNamara
Harold Jacob Mahler
Clement E. Malone
Kenneth A. Malone
Nathan Manus
Myer A. Margolis
Reuben Margolis
George W. Marsden
Jaime Samuel Mas
Ethel Sylvia Maser
William A. Maser
Hyman Matrick
Kenneth D. Meredith
Carl H. G. Mergner
George L. Merman
Samuel M. Meyerowitz
Nelson Miles
J. Walter Miller
James Clyde Monroe
Irving J. Moskovitz
George Peter Moylan
Robert K. Myers
William M. Neamand
Clarence A. Neilson
Max Newman
Morris Leon Olken
Arthur Osol
George Overbeck
Russell W. Payne
Alfonso G. Pennachio
Charles Wesley Perry
Kenneth L. Peterson
Sam Pincus
Samuel Podell
Roy Lambert Pollard
John Lewis Price, Jr.
Samuel Joseph Price
Wilbur Wm. Price
Morris Pritzker
Earl Knoble Prosser
Philip Rappaport
Edward Martin Reese
Paul Desch Reinsmith
Samuel Resnick
Joseph Richter
Marie T. Riley
John A. Roderick
Willard J. Rohr
Ernest L. Rosato
Arthur J. Rosemary
Charles Rosenberg
Reba M. Rosenfeld
David A. Rosenthal
Jacob Sadel
George Jacob Sauber
Percy Jacob Savitz
Lester S. Saylor
David Schiller
Wm. T. Schlappich
Joseph H. Schmieg
Kenneth S. Schnell
Isaiah S. Schwartz
Harry Segel
Russel Spencer Sharp
Anna A. Sheridan
Philip Julius Sherman
Louis Judah Schochet
Ray Belmar Sigmund
James C. Simmons
Louise V. Simon
Kirk Smith
Joseph W. Spangler
Meyer Stein
Harry Wilson Stout
Humbert F. Sweeney
Raymond A. Taylor
Mary M. Timko
Titus Paul Tomasulo
Frederick L. Wagner
Robert B. Waronker
Harry Wm. Weaver
Samuel Wein
William A. Weyman
Ellis Cairns White
Lillian Whitfield
Leon Berman Winer
Abram Wishnefsky
Alfred Wood
Earle S. Wotring
Joseph M. Yablonisky
Nicholas Zacharellis
Paul G. Zimskind
Myer Zitomer

Certificates were awarded as follows:

Certificates in Chemistry (Three-Year Course)

William Allen
Francis John Friel
Charles F. Hurst
Claude S. Keiser
Donald E. Slothower
Donald B. Strohm

In Bacteriology

Irving Biber
Arthur M. Covell
Harry Epstein
Lewis Good Freeman
Merton C. Lockhart
Elsie Agnes McCoy
John Joseph Rozboril
Mary M. Timko
Donald E. Slothower

In Clinical Chemistry

Raymond A. Taylor
William A. Young
Irving Biber
Israel Feldman

In Perfumery and Cosmetics

Donald E. Slothower

HONORS

Because of their high scholastic attainments the following deserve special mention, and proper notations appear on their diplomas:

Graduate in Pharmacy (Ph. G.) Course

DISTINGUISHED

With General Average of Not Less Than 90 Per Cent.

Benjamin Branhut
Sadie Brisgol
Bruce Painter Hoffman
Meyer Aaron Margolis
Abram Wishnefsky

MERITORIOUS

With General Average Between 85 and 90 Per Cent.

Maurice Barr
Joseph Harry Carter
Orville Elwood Deibler
Martin Joseph Dwyer
James Jerome Farrell
Zellman Girzel
Nathan Green
Frank H. Hagadorn
Louis Hauser
Pauline Hornik
Earl Mathias Jensen
Freda Kaigh
Julius Kazan
Ralph George Kern
Leo Lipkin
Leon Solot Liss
Henry Loevner
Reuben Margolis
Samuel M. Meyerowitz
Arthur Osol
Samuel Joseph Price
Morris Pritzker
Phillip Rappaport
Paul Desch Reinsmith
Charles Rosenberg
Davis Abram Rosenthal
Isaiah S. Schwartz
Raymond A. Taylor
Samuel Wein
William Albert Weyman

PRIZES

The **Proctor Prize,** a gold medal and certificate for the highest general average of the class, was awarded to

SADIE BRISGOL

The **William B. Webb Memorial Prize,** a gold medal and certificate for the highest general average in the branches of Operative Pharmacy, Analytical Chemistry and Pharmacognosy was awarded to

SADIE BRISGOL

With Honorable Mention to

Orville Elwood Deibler Myer Aaron Margolis Robert Kenneth Myers
Raymond A. Taylor

The **Remington Memorial Prize,** $20.00, offered by the Estate of Joseph P. Remington, for the highest general average in the examinations in Operative Pharmacy and Dispensing was awarded to

ROBERT KENNETH MYERS

With Honorable Mention to

Theodore C. Chidester	Earl K. Prosser	Russell Spencer Sharp
Francis G. Collins	Jacob Sadel	Mary Margaret Timko

The **Frank Gibbs Ryan Prize,** a gold medal endowed by the Class of 1884, as a memorial to their distinguished classmate, for the best average in the Chemical and Pharmaceutical Laboratory courses, was awarded to

ARTHUR OSOL

With Honorable Mention to

Sadie Brisgol	Myer A. Margolis	Samuel Wein
Martin J. Dwyer	Robert Kenneth Myers	Abram Wishnefsky

The **Mahlon N. Kline Pharmacy Prize,** a Troemmer Prescription Balance, offered by the Mahlon N. Kline Estate, for highest average in Theory and Practice of Pharmacy, was awarded to

SADIE BRISGOL

With Honorable Mention to

Benjamin Branhut	S. J. Price	Myer A. Margolis
Orville Elwood Deibler	Abram Wishnefsky	

The **Bacteriology Prize,** $25.00, offered by the H. K. Mulford Company, to the candidate for graduation making the highest general average

and the highest grade on a special examination, in Bacteriology and Serum Therapy, was awarded to

ADELINE MYERS

With Honorable Mention to

Sadie Brisgol	Guerch Hornik	Asa Neiley Stevens
Pauline Hornik	Charles Russell Lowe	Abram Wishnefsky
	William Kurtz Perry	

The **Business Administration Prize,** $20.00, offered by Professors E. Fullerton Cook, Howard Kirk and Spencer B. Roland for the highest general average in Business Administration, was awarded to

SADIE BRISGOL

With Honorable Mention to

Charles Balaban	Leon S. Liss	John E. Kramer
Lemuel F. Carpenter	Myer A. Margolis	

The **Pharmacy Review Prize,** one year's membership in the American Pharmaceutical Association, offered by Professor Ivor Griffith, for the highest general average in Theory and Practice of Pharmacy in the Senior year, was awarded to

SADIE BRISGOL

With Honorable Mention to

Benjamin Branhut	Samuel J. Price	Myer A. Margolis
Orville Elwood Deibler	Abram Wishnefsky	

The **Maisch Botany Prize,** $20.00 in gold, offered by Joseph Jacob, Ph. G., Phar. D., D. Sc., of Altanta, Ga., for the best herbarium collection of plants, was awarded to

WILLIAM TOMPKINS AXLINE

The **Advanced Pharmacy Prize,** ten dollars' worth of books, offered by Professor Charles H. LaWall, for the highest grade in Advanced Pharmacy, in either the Ph. G. or the Phar. B. course, was awarded to

J. HAMPTON HOCH

The **J. B. Moore Memorial Prize,** $25.00 in gold, offered by the Rev. J. J. Joyce Moore and Mrs. H. H. Watkins, Jr., in memory of their father, J. B. Moore, to the candidate for graduation offering the best thesis representing work in the Department of Pharmacy, was awarded to

GUERCH HORNIK

With Honorable Mention to

Adeline Myers John E. Frankfurt

The **Kappa Psi Fraternity Prize,** a gold medal, awarded to a Kappa Psi student graduating with degree Ph. G., receiving the highest general average of any student of his fraternity, was awarded to

Bruce Painter Hoffman

PRIZES AWARDED BY THE ALUMNI ASSOCIATION

The **Alumni Gold Medal,** for the highest general average in all branches in the Senior Year, was awarded to

Sadie Brisgol

The **Alumni Prize Certificates** for the highest general average in individual branches in the Senior Year of the Ph. G. course were awarded as follows:

Pharmacy	to	Sadie Brisgol
General Chemistry	to	Raymond Abbott Taylor
Materia Medica	to	Bruce P. Hoffman
Operative Pharmacy	to	Robert Kenneth Myers
Analytical Chemistry	to	Abram Wishnefsky
Pharmacognosy	to	Bruce P. Hoffman
Business Administration	to	Sadie Brisgol

PRIZE AWARDED TO UNDER-GRADUATE STUDENT

The **Alumni Silver Medal,** for the highest average in all branches in the Junior Year of the Ph. G. course, was awarded to

Edwin Lynch Murphy

COUNTRIES AND STATES REPRESENTED BY CANDIDATES FOR GRADUATION

Pennsylvania, New Jersey, Maryland, Ohio, Illinois, Kansas, South Carolina, New York, Wisconsin, Massachusetts, Texas, Tennessee, Idaho, Delaware, Minnesota and Mexico.

SCIENTIFIC AND TECHNICAL ABSTRACTS

SELENIUM COMPOUNDS AS WEED KILLERS.—Selenium compounds were found more useful in destroying weeds than as insecticides for trees and plants by scientists of the University of Illinois in testing the possibility of substituting selenium for sulphur compounds in plant sprays. Selenium, a member of the sulphur group, is more poisonous than the latter, but was found to be injurious to foliage. But the properties which make selenium compounds undesirable for spraying trees in leaf may make them useful for combating pear blight, oyster-shell scale, blister canker and other plant diseases, in the opinion of the experimenters. Compounds of this substance are very deleterious to such plants as dandelions, burdock and plantain but hardly affect grass and clover, a fact which points to their possibilities as good weed eradicators.

PREVENTION OF RUST IN THE STERILIZATION OF SURGICAL INSTRUMENTS.—Information of special interest to hospital pharmacists is summarized in the foregoing paragraph, quoted from an excellent article on the above stated subject, in *Dental Cosmos* (1925, *67*, 752) Crowell. The chief cause of the rusting of dental instruments is sterilization. Rusting can be minimized by—

(1) Cleaning the instruments before sterilization.

(2) Adding to the water in the sterilizer one teaspoonful of sodium carbonate (washing soda), and one teaspoonful of 30 per cent. sodium nitrite (not nitrate) solution per quart.

(3) Removing the instruments from the sterilizer *at once* and wiping them dry.

(4) Draining the sterilizer at least once a day and thoroughly cleaning it.

(5) Storing the instruments under cover in a dry place.

Nickel-plating can be expected to protect instruments against the conditions of ordinary storage and handling but not against the more powerful corroding action of sterilization.

A New Source of Potassium Sulphate.—A vast supply of potash for the American farmer, independence in the future from European supplies and the establishment of a new great industry in the United States are all possible as a result of a new process for making potassium sulphate from the great quantities of green sand found in New Jersey, Delaware and Maryland, Dr. J. W. Turrentine, C. W. Whittaker and E. J. Fox, soil chemists of the United States Bureau of Soils, told the American Chemical Society at its recent meeting.

The process has been made economically possible by the manufacture of valuable by-products such as alum, alumina, ochers and glaucosil, a new earthy absorbent. The new process has been practically demonstrated in the laboratories of the Electro Company at Odessa, Delaware. The method consists in extracting the raw material with sulphuric acid. The green sand deposits, which are practically at the surface, can be worked with steam shovels, and Dr. Turrentine said that they are ideally located with respect to water or rail transportation, labor supplies and market.

A Peculiar Adulteration of Wine.—The Governor-General of Algiers has issued an order against the practice which has arisen in that region of adding potassium ferrocyanide to wine in order to remove excess of iron. He points out that inasmuch as the reaction of wine is acid, there is danger of conversion of the ferrocyanide into cyanide.

Fixation of Nitrogen in France.—In an address before the Faculty of Applied Science of the University of Brussels, Georges Claude detailed at some length his work in connection with the perfection of a method for uniting hydrogen and nitrogen. The address was published in the Bulletin of the Industrial Federation of Belgium, and republished in *Ann. Chim. App.*, etc., [2], 1925, 7, 152, from which the following abstract is taken. Claude has been very prominent in developing the synthetic ammonia method, along lines similar to those that the BASF uses under Haber's guidance. The essential features of these are the employment of very high pressure, high temperature, and the association of a catalyst. The last is, indeed, the crux of the method, and so far the catalyst has not been

definitely stated. In the address, Claude reviews the earlier steps of the method and especially the known details of the German procedure. He claims a much higher yield than the BASF obtains even now, by using very high pressures. He reviews the recent history of the Haber method, pointing out that it was not until 1905 that a definite synthesis of ammonia was effected, notwithstanding the fact that theory indicated such a result. In that year, Haber, operating at about a red heat, succeeded in obtaining a small yield of ammonia, by using a catalyst. The mechanical problem in using very high pressures with moderately high temperature is a serious one, as most metals suffer material loss of tensile strength when strongly heated. Claude asserts that the honor of having shown the method of constructing apparatus that would bear a pressure of about 1000 pounds to the inch at a high temperature belongs to Nernst and not to Haber. The earlier experiments were, however, discouraging. Haber, himself, in a discussion with Nernst, at a meeting of the Bunsen Society, expressed fears as to the operation of a process involving such pressures, yet it was Haber who afterwards employed as high as 3000 pounds, having observed the catalytic powers of certain uranium compounds. In this way, Claude remarks with some pathos, a simple laboratory experiment became under the support of a great chemical company, the means of prolonging for "three mortal years" a terrible war. The reference is to the fact that without this nitrogen fixation process, Germany would have been soon brought to a standstill for lack of nitric acid and fertilizers. It was stated in a recently published German work on nitrogen fixation that from the establishment of the blockade in August, 1914, until the middle of the next January only 5000 tons of sodium nitrate reached German ports. It seems likely that if the Haber process had not been installed, Germany would not have gone into the war.

Claude claims much superiority in yield in his method, which he designates as "hyperpressure," obtaining about 40 per cent. of the materials in the form of ammonia while the Haber method gives only about 6 per cent. Moreover, by passing the gas at the high pressure through pipes surrounded with cold water, the ammonia is obtained in liquid form and if the gases originally introduced are dry, anhydrous ammonia is obtained. He operates at about 13,500 pounds to the inch (900 atmospheres). The apparatus is not described in detail, and only a portion is figured, but a circulation of the gases in tubes is used and by treatment four successive times, as high as

87 per cent. yield is obtained. A special alloy is used for the tubes, and it is stated that some of these have already been operated for 7000 hours and show no signs of failure. Finally, it is stated that a factory is being erected in France which will have a capacity of sixty tons (presumably metric tons) of anhydrous ammonia per day.

H. L.

WHAT IS COAL?—The high price of coal has naturally led to sale of inferior products. The matter was brought into legal notice by the sale in Massachusetts of material under the name of coal which was largely the refuse of the mines. A sample was submitted to the Department of Public Health which when hand-picked was found to consist of about 75 per cent. of slate and the remainder was considered coal. In March, 1923, a law was enacted according to which the permissible limits for ash are from 13 per cent. to 20 per cent. according to size, the smallest form (pea) being allowed the higher limit. In the anthracite industry, the mine-yield is graded into slate, containing less than 40 per cent. of carbon, bone, containing more than 40 per cent. and less than 60 per cent. of carbon, and coal with a proportion of carbon over 60 per cent. The data of this abstract are taken from a reprint from "The Retail Coalman," the laboratory work having been carried out by Mrs. Eden and Messrs. Hall and March of the Massachusetts State Board of Health.

H. L.

NEWS ITEMS AND PERSONAL NOTES

PROFESSOR LUCIUS E. SAYRE, DECEASED.—Dean Sayre, whose long and honorable career in pharmacy and the allied sciences, brought him into contact with a wide circle of friends, terminated a life of great service on July 20 after a short period of illness. He was seventy-eight years old, having been born at Bridgeton, N. J., November 2, 1846. He graduated from the Philadelphia College in 1866 and for several years served as an instructor in Materia Medica at the College. During his Philadelphia residence he was at one time associated with Professor Remington in the conduct of a retail and manufacturing pharmacy. Later he accepted the deanship of the School of Pharmacy of the University of Kansas, a position which

he occupied with honor and signal service until the last. To have remained in this capacity for four decades is testimony enough of this man's abilities and of the stability of his service and character.

Professor Sayre was keenly interested in pharmacy and its organizations and was a member of the American Pharmaceutical Association and an honorary member of the Kansas Pharmaceutical Association. The American Pharmaceutical Association honored him with the presidency in 1919 and he presided at the meeting held in New York. He held the degrees of Ph. G. and Ph. M. from the Philadelphia College of Pharmacy and in 1896, the University of Michigan conferred an honorary Bachelor of Science degree upon him.

He was a member of the revision committee of the United States Pharmacopœia since 1890, and since 1907, was director of drug analysis of the Kansas State Board of Health. He was also a member of the committee on definitions and standards connected with the Bureau of Chemistry of the United States Department of Agriculture, as well as being a member of the botanical staff of the Kansas State Board of Agriculture. The deceased is survived by two sons and two daughters: William P. Sayre, Kansas City, Mo.; Lucius Sayre, South Orange, N. J.; Mrs. Mabel F. Cone, Rozel, Kansas; and Mrs. Jeanette P. Canfield, Ann Arbor, Michigan.

Bureau of Chemistry Ready to Distribute Biological Standards.—Word has been received from the Bureau of Chemistry that they are now prepared to supply standard substances conforming to the biological assay requirements of the U. S. Pharmacopœia, Tenth. Manufacturers are invited to make application and to indicate the approximate amount of material they may desire to receive from the bureau. All who desire such standard substances against which to check their biological assays should make application at this time, addressing their communication to the Bureau of Chemistry, Department of Agriculture, Washington, D. C. E. Fullerton Cook, Chairman of the Committee of Revision.

The New Scarlet Fever Products.—Scarlet fever has long been an enigma. Its cause was unknown and the treatment was entirely symptomatic and empirical. For years the idea was prevalent

that a filterable virus was responsible for the disease. True, the earlier work on the bacteriology of scarlet fever indicated the presence of streptococci in the throats of scarlet fever patients, but these were then considered secondary invaders.

Beginning about 1912, a concerted attack, by a number of laboratory workers was begun on the problem of scarlet fever and success has crowned their efforts, so that it is now possible to state that a certain type of streptococcus is the cause of scarlet fever. It has also been determined that the scarlet fever streptococci differ from other common forms of the streptococcus, that they possess certain peculiarities of their own, and that the specific organism is present in the throat and not usually in the blood stream in uncomplicated scarlet fever.

In seeking experimental proof that the streptococci were the causative factors of scarlet fever, laboratory animals were found insusceptible, but tests on human volunteers proved the point. Thus was the foundation laid for the succeeding steps. Proof was soon brought out that in scarlet fever the streptococci grow locally in the throat, but produce a soluble toxin which enters the blood stream. It is this toxin which gives rise to the symptoms of scarlet fever.

The practical application of these findings led to (a) methods of producing and purifying the toxin, (b) the use of the toxin in skin tests to determine susceptibility to scarlet fever, (c) the use of the toxin for prophylactic immunization to establish an active immunity in susceptible individuals, and (d) the production of a scarlatinal antitoxin possessing the power to neutralize the scarlet fever steroptococcus toxin.

The above outlines the main steps in the study of scarlet fever, to which many research workers have contributed. Much important work on the biology and classification of streptococci, including scarlet fever streptococci, has been carried on for a number of years at the Biological Laboratories of the H. K. Mulford Company. Their research staff has made important contributions to the methods of producing and purifying scarlet fever toxin. Their extensive facilities and long years of experience have been applied to the problem of producing an efficient and powerful scarlatinal antitoxin.

The result is that the medical profession now has available three highly specific and valuable Mulford Products. We refer to (1) Scarlatinal Toxin Diagnostic, which is used in the Dick Test, to determine susceptibility to scarlet fever, (2) Scarlatinal Toxin

Prophylactic, which is offered in strength and dosage found safe but efficient in producing active immunity to scarlet fever, and (3) Scarlatinal Antitoxin, a new antitoxic serum of proven therapeutic efficiency, containing both antitoxin and antibacterial immune bodies.

For further information on these products, methods of preparation, dosage recommended and packages supplied, readers are referred to the H. K. Mulford Company, Philadelphia, Pa.

NATIONAL CONFERENCE ON PHARMACEUTICAL RESEARCH, RESEARCH INFORMATION, JULY, 1925.—The fourth annual meeting of the National Conference on Pharmaceutical Research will be held at Fort Des Moines Hotel, Des Moines, Iowa, on Saturday, August 22, 1925.

There will be two sessions; one beginning at 10 A. M. and the other at 2 P. M.

The Tentative program is as follows:

1. Roll call.
2. Reports of officers.
3. Reports of the ten standing committees.
4. Reports from delegates from the affiliated organizations; *viz.:*

(a) Association of Official Agricultural Chemists.
(b) American Chemical Society, Division of Chemistry of Medicinal Products.
(c) American Conference of Pharmaceutical Faculties.
(d) American Drug Manufacturers' Association.
(e) American Pharmaceutical Association.
(f) American Pharmaceutical Manufacturers' Association.
(g) Bureau of Chemistry, U. S. Department of Agriculture.
(h) Joint Committee on Definitions and Standards of Food and Drugs.
(i) National Association of Boards of Pharmacy.
(j) National Association of Retail Druggists.
(k) National Formulary Revision Committee.
(l) Pharmaceutical Laboratory Seminar.
(m) Plant Science Seminar.
(n) Proprietary Association.
(o) U. S. P. Revision Committee.

5. General Discussion on:

   (a) Census of Research.
   (b) Graduate students in pharmacy and their research work.
   (c) Research topics.

6. New business.
7. Election.
8. Adjournment.

A large attendance is confidently expected.

H. V. Arny, *Chairman.*

115 West 68 St.,
New York, N. Y.
July 21, 1925.

BOOK REVIEWS

METHODS OF ANALYSIS. Association of Official Agricultural Chemists, Washington, D. C.

The second or 1925 edition of Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists, prepared by the Committee on Editing Methods of Analysis consisting of R. E. Doolittle, Chairman; G. W. Hoover, W. H. MacIntire, A. J. Patten, B. B. Ross and J. W. Sale, is now ready for distribution. In this edition the methods, as given in the previous or 1920 edition, have been revised to include the additions, deletions, and other changes made at the 1919, 1920, 1921, 1922 and 1923 meetings of the association. The revision has been thorough, extending even to rearrangement of material and the addition of chapters on agricultural liming materials and gelatin.

The new edition has thirty-two chapters under the following headings, Fertilizers, soils, agricultural liming materials, plants, insecticides and fungicides, tanning materials, leathers, waters, brine and salt; feeding stuffs, preservatives and artificial sweeteners, coloring matters in foods, metals in foods, sugars and sugar products, fruits and fruit products, canned vegetables, cereal foods, meat and meat products, gelatin, dairy products, fats and oils, baking powders and baking chemicals, spices and other condiments, vinegars, coffees, teas, cacao products, flavoring extracts, wines, distilled liquors, beers, drugs, reference tables.

This edition has 510 pages, exclusive of the index; the printing is upon a good quality of paper; and the book is strongly and attractively bound. The price is, for North America and United States possessions, $5 net, postpaid; for all other countries, $5.50 net, postpaid.

This excellent book, familiarly known to the practical laboratory worker as the A. O. A. C. should find a place in the consulting library of every analyst.

COMPANION VOLUME TO THE FIRST EDITION OF CHEMICAL SYNONYMS AND TRADE NAMES. By William Gardner. Royal Octavo. 55 pp. cloth, 7s. 6d. Crosby Lockwood & Son, Stationers, Hall Court, London E. C. 4.

The writer had the pleasure to review Gardner's Chemical Synonyms in the AM. JOUR. PHARMACY, July, 1924, pp. 538 and 539. The present Companion Volume, before us, has been published in order that purchasers of the First Edition may keep the Dictionary up to date. The book contains an additional 2700 definitions and cross-references arranged alphabetically in two columns. These additions include minerals, alloys, dyestuffs, chemicals and pharmaceuticals. The short definitions in the work are quite helpful to the user. This Appendix brings the "mother volume" up to date so it will remain a standard reference book.

PHARMACEUTICAL BOTANY. "Botany without Tears." For Students 12 mo. 300 pp., 201 Illustrations. Cloth 5s. 4d. Published 1925 at the offices of The Chemist & Druggist, 42 Cannon St., London, E. C. 4.

The readers of *The Chemist & Druggist* will no doubt recall the excellent series of articles on Pharmaceutical Botany which were begun in January, 1914, interrupted by the World War and started again in 1923. After completion in 1924 these weekly monographs by numerous requests were published as the book before us.

An endeavor has been made and successfully made to remove the impression that botany is a "dry as dust" science consisting of lists of botanical terms and definitions. In plain language the subject is treated in such a manner that the student can fully understand it and even become interested. Six pages and three illustrations are devoted to Digitalis, a proof how thorough the monograph is written.

The book certainly deserves its subtitle "Botany without Tears." While primarily intended for students preparing for the qualifying examinations of the Pharmaceutical Societies of the British Empire,

it will also be a great help to the American student. We hope that the book will become better known in the United States!

FRITZ ELSNER: DIE PRAXIS DES CHEMIKERS. Bei Untersuchungen von Nahrungs—und Genussmitteln, Gebrauchsgegenständen und Handelsprodukten. Bei hygienischen und bakterioligischen Untersuchungen, sowie in der gerichtlichen und Harnanalyse. 9. verbesserte und umgearbeitete Auflage. Von Dr. W. Plücker, Direktor der öffentlichen Hahungsmittel—Untersuchungsanstalt Solingen. Lex. 836 pp. mit 150 Abbildemgen. $7.20 Verlag von Leopold Voss, Salamonstr. 18B, Leipzig.

In 1880 Fritz Elsner, pharmacist and chemist, published the first edition of this masterwork, which, as the preface indicates was especially intended for his colleagues, the Apotheker. Elsner himself wrote eight editions of the book up to 1907, a sure proof of a well-deserved popularity. Eight editions within twenty-seven years for a work of this kind is a record breaker!

After the death of Hofrat Dr. Elsner the revision was undertaken by another authority, Dr. W. Plücker, Director of the Chemical Laboratory in Solingen, who just completed the ninth edition before us. The book is divided into two parts.

I. General Part, subdivided into Bacteriologic, Biologic, Microscopic, Chemical and Physical Methods, each of which is presented in a plain, concise and practical manner.

II. Special Part: Analysis of Meat, Sausage, Meat extract, Fish, Eggs, Milk, Cheese, Fats and Oils, Cereals, Vegetables, Honey, Fruits, Fruit juices and—Syrups, Beer, Wines, Liquors, Vinegar, Coffee, Tea, Cacao, Spices, Tobacco, Water and Air. Then follow chapters on Forensic Chemistry, Analysis of Wine, Gastric Contents, Sputum, Inks, Textiles, Paper, Varnishes, Petroleum, Lubricants, Soaps and Waxes.

Truly a compilation of practically anything which is to be analyzed!

The book is comprehensive, systematic and above all written in

a pleasant, agreeable style. In short, it is a masterwork, which should be duly appreciated on both sides of the Atlantic.

Thanks are also due to the well-known publisher, as the paper, print, illustrations and binding are excellent and cannot be improved.

THOMAS ALVA EDISON. An Intimate Record. By Francis Arthur Jones. Octavo 399 pp. Cloth $2. Thomas Y. Crowell Co., New York City.

Some sixteen years ago this life story of Edison first appeared under the subtitle "Sixty Years of An Inventor's Life." With the long list of achievements then credited to our great American inventor, it seemed that his life chronicle was complete. But Edison, aided by Father Time, celebrates each successive birthday by working harder than ever.

In the book before us all the original material has been retained and the chronology has been brought up to date. It presents an intimate biography from the standpoint of a personal friend. The book contains the picturesque story of Edison's boyhood, with chapters on each of his great discoveries, such as the incandescent light, the phonograph, the storage battery, the ore separator, etc., etc. These are all discoveries with which the educated pharmacist should be acquainted!

The publisher, B. G. Teubner, Poststr. 3, Leipzig, submitted the two following books for review.

EINFÜHUNG IN DIE BIOLOGIE. Von Prof. Dr. Kraepelin. 5. verbesserte Auflage von Prof. Dr. C. Schäffer. Octavo 357 pp. mk. 5.

Karl Kraepelin, the father of the study of biology in the schools of Germany is dead (June 28, 1915), but his works and especially his favorite book live after him. The new, fifth edition, before us is an excellent treatise on this subject, in plain language, readily understood. I must not forget to call attention to the 461 illustrations

in the text, five plates, four of which are in colors and are regular works of art. All of these still furthermore help to elucidate the text. We wish the book the best of success.

DAS MIKROSKOP. Von A. Ehringhaus. 12 mo. 161 pp. Mk. 1.60.

This little book is vol. 67S of the library "Aus Natur und Geisteswelt," issued by the publisher. It is a short, concise, but excellent treatise on optics, the microscope and its technique. The seventy-five illustrations in the text are very helpful. For those interested, and the real pharmacist always is, the little volume forms an excellent pocket and hand-book!

OTTO RAUBENHEIMER, Ph. M.